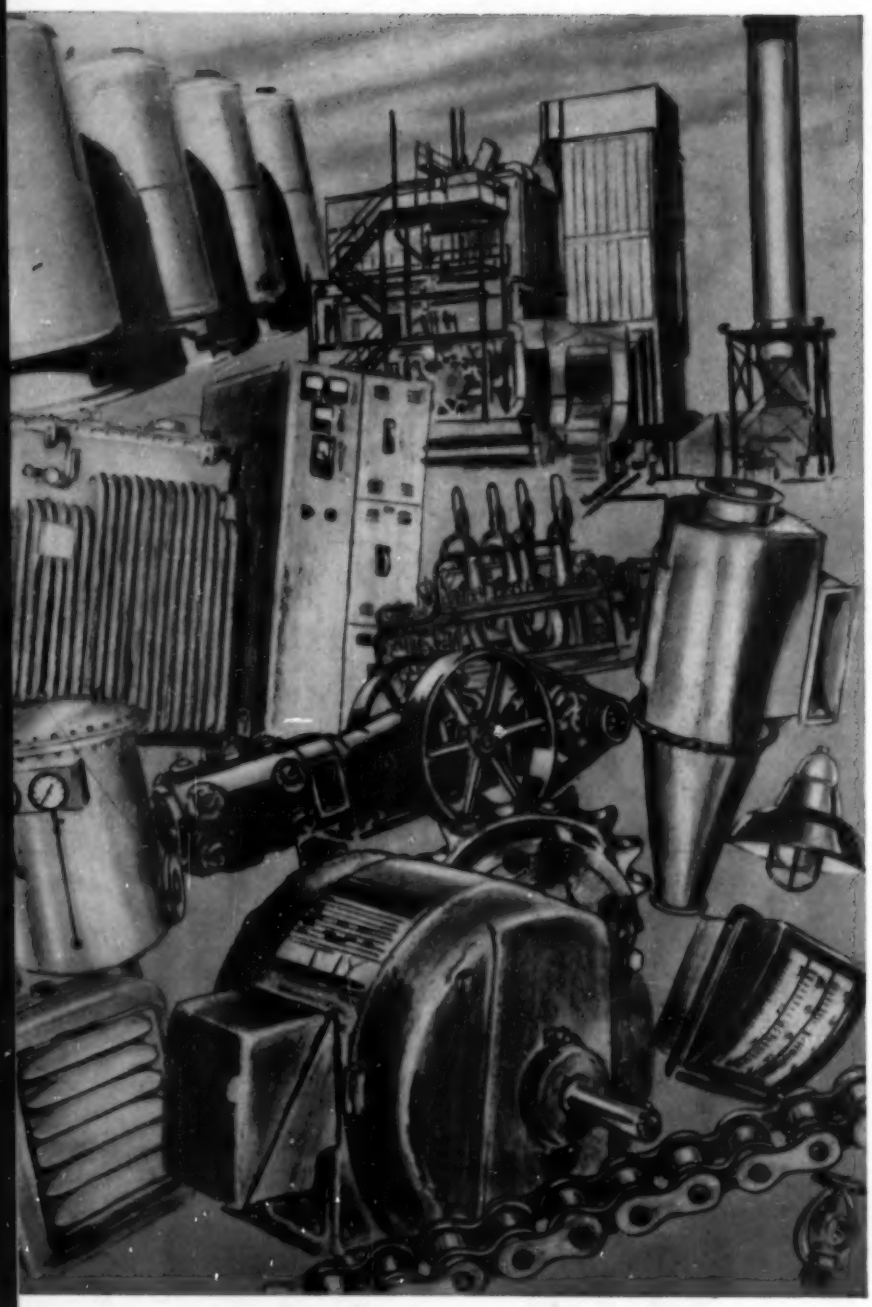
Industry and Power



January 1954

Industrial Development Review

An issue of feature articles reviewing industrial developments and looking to the future

●

Power

Generators and Motors

Heating and Air-Conditioning

Instrumentation and Control

Materials Handling

Water Treatment

Compressors

Electrical Distribution

Pumps

Power Transmission

Lubrication

Vibration and Noise Control

Industrial Lighting

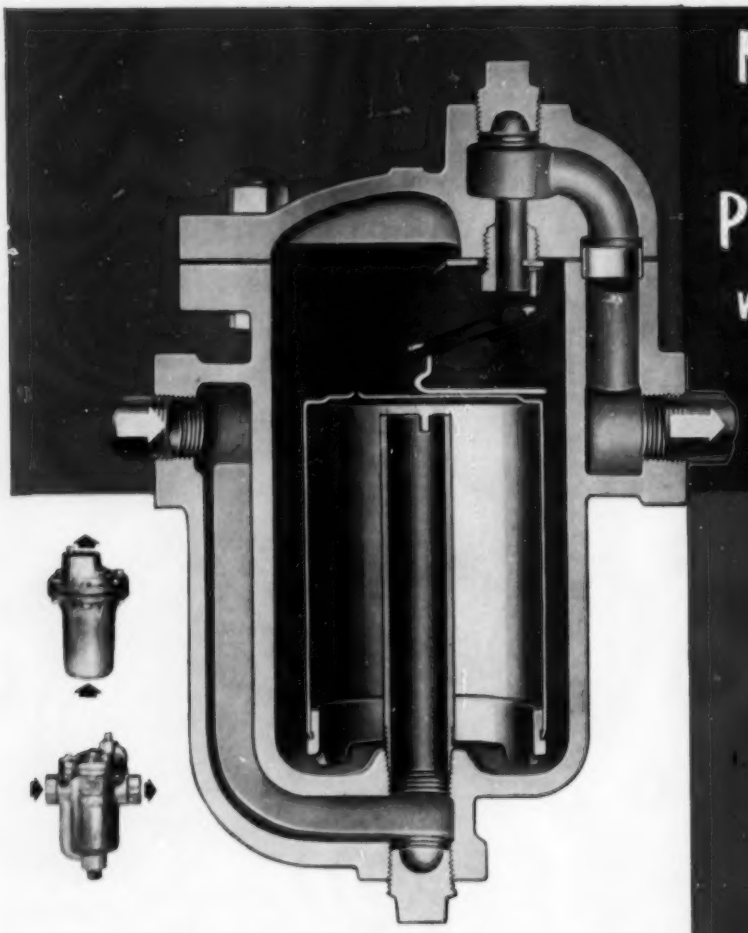
Fire Protection

●

for engineers and executives responsible for

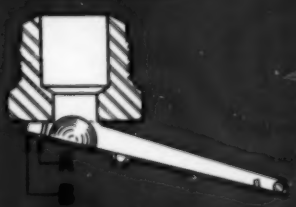
— engineered plant facilities

MORE TRAP CAPACITY PER DOLLAR with Armstrong two-phase leverage



HOW IT WORKS:

1. Valve in closed position.



2. As the bucket starts to sink, the lever fulcrums at "A", giving high leverage to open the valve against pressure. When valve is well open, the secondary fulcrum "B" touches the face of the valve seat.

3. Additional bucket travel results in fulcrum "B" becoming the pivot, permitting the valve to be opened wider so that restriction to flow of condensate is minimized.

Two-phase steam trap leverage is an original development by Armstrong and has been incorporated in Armstrong traps since the memory of most engineers runneth not to the contrary. It provides:

1. High initial leverage to open the valve against pressure.
2. Secondary lower leverage which permits the valve to travel well clear of the seat to minimize restriction to flow of condensate.

A single-phase lever can open just as large a valve *or* give just as great valve travel, ***but not both.*** Thus, Armstrong two-phase leverage gives very much greater capacity, depending on trap size than the earlier leverage system.

No steam trap gives greater actual hot condensate capacity, size for size, and dollar for dollar, than an Armstrong!

For complete data call your local Armstrong Representative or send for the 44-page Steam Trap Book.

ARMSTRONG MACHINE WORKS
820 Maple Street, Three Rivers, Michigan

ARMSTRONG STEAM TRAPS

Circle 500 on Reply Card for more data

EASIER ON CARS with minimum noise level . . . thanks to exclusive low-frequency vibration. The Link-Belt Car Shaker helps hopper cars empty themselves. Even hard-packed loads come "broom clean" in a matter of minutes. Especially good for damp, sticky materials. Write for Book 2345.

BOTTOMS UP . . . empties 90-ton car every 60 seconds or less (including return to upright position) by simply turning car upside down. Simple, automatic, foolproof. Takes all open-type cars—any length, width or height . . . up to 90-ton or 120-ton capacity. Book 2048-A has complete data.

Railroad cars come clean . . . in as little as 60 seconds or less!

For fast, safe, push-button car unloading . . . at substantial savings — choose Link-Belt equipment

IF you empty a few gondola cars a day—or several thousand a week, Link-Belt makes the right railroad car unloader for your particular requirements. Only Link-Belt builds both types—the automatic Rotary Car Dumper for large users . . . the low-frequency Car Shaker for smaller operations.

Both are precision engineered to reduce unloading hazards, minimize injury possibilities, cut costly demurrage charges.

Yes, if your operations require rapid railroad car unloading of any bulk material, it will pay you to call your nearest Link-Belt representative. He'll give you an unbiased recommendation for the right type of equipment for your needs.

LINK-BELT

CAR SHAKERS and ROTARY DUMPERS

LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Colmar, Pa., Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle, Toronto, Springs (South Africa), Sydney (Australia). Sales Offices in Principal Cities. LB 289

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The Class VCE-3, Three Stage, High Pressure Compressor is ideal for heavy-duty blowing cycles. Simple, well balanced design is afforded by vertical, in-line cylinders which permit a compact, space-saving inter-cooler arrangement and easy installation. The "one-connecting-rod-to-a-crankpin" feature plus its all-'round rugged construction insure 24-hour a day dependability with minimum maintenance. Available with electric motor or other drives in moderately rated sizes 200 to 450 hp, the VCE-3 assures "safety-plus" operation at 500 lbs. Write for Bulletin 733. *Chicago Pneumatic Tool Company, 8 East 44th St., New York 17, N. Y.*

Station Air—Type "Y" Compressor—Compact, economical and easily installed—requires simplest of foundations—needs no alignment. Available from 75 hp to 250 hp, 410 cfm. to 1663 cfm. Write for Bulletin 766.

Instrument Air—CP Oil-Less Cylinder Compressors—need no oil or other lubricant. Designed for continuous service with minimum attention. Ask for Catalog 728 Supplement D.

Portable Air Compressors—Have CP gradual speed regulator—paces engine speed to air demands for fuel economy. Available from 60 cfm. to 600 cfm. Ask for Bulletin 758.

Chicago Pneumatic

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Both *Inch-Pound* and *Foot-Pound* Models of Amazing PROTO Torquer Now Available!

"Tool users everywhere have acclaimed the amazing PROTO *torque-limiting* wrench as the sensation of the tool industry!" In addition to foot-pound models, you can now buy *inch-pound* styles with all of the features that made the Torquer famous overnight. Thousands of jobs can now be handled with the various inch-pound and foot-pound capacities, different drive sizes and plain or ratchet head styles available. Whether used for repair, assembly, inspection or installation work, the super-fast Torquer pays for itself in time saved. Buy the model you prefer from your PROTO dealer today! Send 10¢ for 68-page catalog of entire line to

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PROTO TOOLS

Eastern Factory—Jamestown, N.Y.
Canadian Factory—London, Ont.

Circle 503 on Reply Card for more data

acorns

. . . recently announced . . . worth watching

Global Grease

● Texaco has developed a new grease to lubricate vehicle bearings in temperatures ranging from -65 F to 125 F. The grease is said to perform effectively in desert heat or arctic cold. It should help relieve logistics problems created by necessity for ordering, storing, transporting, and applying large variety of greases tailored to specific ambient temperatures.

Glass-Steel Tubing

● Recent technical advancements in processing of glass coated steel tubing promise eventual relatively low cost solutions to the costly problem of air heater outages.

The Barrows Porcelain Enamel Co. has evolved special equipment to glass coat long lengths of steel pipe up to four inches in diameter, both inside and out, with smooth unmarked surfaces. It is a continuous operation with marked production economies.

Accelerated tests indicate that long term protection can be obtained by the glass coatings. Several field tests are now under way. Preliminary examination of glass lined tubes on one installation after twelve months' indicates no perceptible change in the original condition of the glass surface.

Tiny Transistor

● A thimble-size power-type transistor that is 100 times as powerful as present commercial available types has been developed in the research laboratories of the Minneapolis-Honeywell Regulator Co. Its output of 20 watts is enough to operate motors, valves, relays, and other equipment previously impossible to use with transistors. The new transistor will likely play a major role in improving future automatic controls.

Conservation

● Faced with rapid depletion of natural resources, more emphasis is being given to the discovery and utilization of energy and raw material supplies previously considered uneconomical to exploit. Iron ore producing companies expect that Lake Superior low-grade iron ores will become an important source of total iron ore supplies, perhaps to the extent of 20 million tons.

Attention is also being given to the by-product recovery of materials that were previously wasted. Cases in point are the recovery of molybdenum from copper ores, cobalt and iron from nickel, germanium from zinc, and useful products from waste gases.

NA22H

● A new heat resistant alloy, NA-22H, announced by the National Alloy Division of Blaw-Knox Company, will permit (1) increased furnace capacity and efficiency by increasing the rate of heating through use of higher heat heads; (2) practical engineering design permitting temperatures up to 2200 F; and (3) longer alloy life per dollar invested because of the alloy's superior structural stability and resistance to oxidation.

Predictions

● By 1963, homes may be made partly of plastic, will have electronically controlled air conditioning and heating, probably will include a seeing telephone and may receive electricity from an atomic power plant, says John E. Haines, a vice-president at Minneapolis-Honeywell and also vice-president of the American Society of Heating and Ventilating Engineers.

Among other predictions—transmission of power and signals of all types will eliminate wires and cables—many processes and even complete manufacturing plants will become almost completely automatic—plastics will partly replace metals and building materials.

Latest X-Ray

● The first prototype unit of the newest X-ray development—Xeroradiography — is being tested by the Aluminum Company of America. What promises to be the most significant aspect of Xeroradiography is its extreme speed of image development, 45 seconds. This should expand the use of X-rays to many metal-working firms. Regular continuous production line inspection in the foundry industry may be a future result of the new field of Xeroradiography.

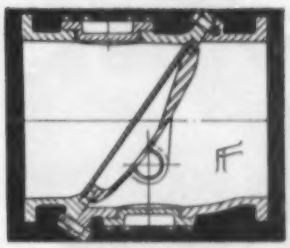
QUIET

Do Not Disturb Pipelines

You hang this sign on every line, when you install Chapman Tilting Disc Check Valves. For these unique check valves don't slam or hammer, under usual piping arrangements. And that means no damage to pipeline joints . . . virtually no wear in the valve itself.

Cross section at the right shows you how the airfoil design of the disc makes these valves *keep quiet* all their working lives . . . shows you why, in any installation, head loss is reduced over regular swing-type checks. Send for Publication No. 30, showing charts of test-results at leading engineering laboratories. Write today.

The Chapman Valve Manufacturing Co.
INDIAN ORCHARD, MASSACHUSETTS



Here's why
CHAPMAN Tilting Disc Check Valves
***Keep Quiet* All Their Lives**

This specially designed "airfoil" disc balances perfectly in open position . . . then drops easily to closed position (cushioned by the flow). No jarring or slamming, in usual pipe-layouts. Write for bulletin.

CHAPMAN TILTING DISC **CHECK VALVES**

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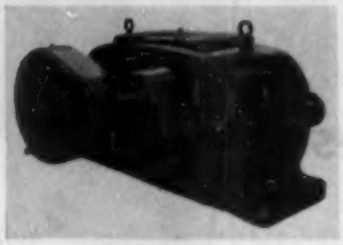
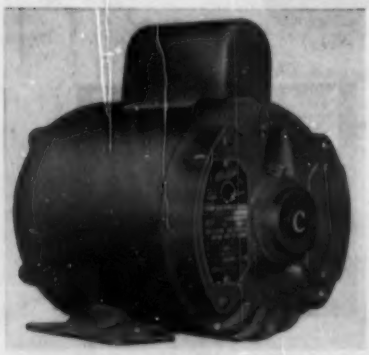
new equipment

. . . new developments



Two models added to variable speed drives line

A10 Link-Belt P. I. V. positive, infinitely variable speed drives are now available in two new types for 20 to 25 hp applications. These two types, the HG-6 drive, furnished with either a single reduction input or single reduction output helical gear attachment, and the HGG-6 drive, furnished with both a single reduction input and single reduction output helical gear attachment, are being offered in addition to the basic H-6 P. I. V. of 25-hp capacity. Input gear reductions are available from 1.93 to 1 minimum to 5.82 to 1 maximum, and output gear reductions from 1 to 1 to 6.33 to 1. The drive is said to be unaffected by high or low temperatures, humidity, abrasive dust, or explosive vapor conditions. A bulletin is available.

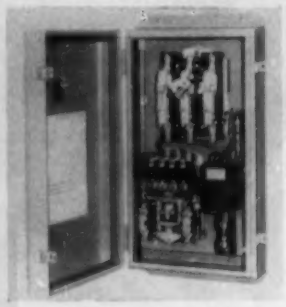


Motors are available with new NEMA standards

A11 Century Electric Company is now producing fractional horsepower motors in the rerated NEMA design. To be known as Century Form "F" motors, they are available as TYPE SP Split Phase Single Phase Induction motors for general purpose applications where the load is easy to start and easy to pull up to speed; TYPE CS—Capacitor Start Single Phase Induction motors for hard to start applications such as pumps, compressors, and for machines starting loaded; and TYPE SC—Squirrel Cage Polyphase (3 or 2 phase) Induction motors for all general purposes.

Continuous hydrogen analyzer developed

A12 A hydrogen analyzer—capable of detecting as little as 0.1 part of hydrogen per 10,000 parts of air—has been developed by Taller & Cooper, Inc. When installed the instrument, which analyzes instantly and continuously, is said to do away with the lengthy method of withdrawing random samples for laboratory analysis that is now used.



Starters are compact in construction

A13 A-c combination starters with disconnect switches, designed and built in accordance with Joint Industrial Council standards, is announced by Ward Leonard Electric Co. Known as Bulletin 4120 J.I.C. Starters, they are intended for use wherever non-reversing magnetic across-the-line starters with disconnect means at the starter location are specified. Outstanding features are compact construction; quick make and break disconnect switch mechanically interlocked with cover; front of board wiring; removable mounting panel; external mounting holes, oil clearance pads on rear of enclosure; easy access to shallow box for component inspection and maintenance.

Pillow block housing occupies less space

A14 A new series of light-duty, low-cost, ball bearing pillow blocks have been designed by the Fafnir Bearing Company. Designated as Type PB, these pillow blocks are a complete, ready-to-mount, economy package. The housing, which occupies less space than other pillow blocks for the same shaft size, incorporates a prelubricated Fafnir Wide Inner Ring Ball Bearing with Self-Locking Collar. Fafnir contact-type Plya-Seals are said to provide efficient grease retention and contaminant exclusion to minimize maintenance and extend bearing life. Descriptive literature is available

Pressure cell has self-contained adjustment

A15 A new transducer, the Dynaformer Pressure Cell, has been introduced by The Foxboro Company. Said to be highly sensitive, the element converts fluid pressure into a proportional a-c voltage which is measured in terms of pressure by a Foxboro Electronic Resistance Dynalog instrument. The cell is accurate to within ¼ percent at any point and is protected against overrange to 150 percent of its

NOTE—Each new product item has a key number for your convenience in asking for additional, detailed information. Circle this number on Reply Card, pages 36/37 & 92/93.

JENKINS PRACTICAL PIPING LAYOUTS 70

How to plan an INDUSTRIAL WASTE TREATMENT SYSTEM

In many areas, stringent codes have been drawn up to regulate the types and condition of waste which may be discharged into streams and rivers, in order to conserve existing water supply sources.

Industrial discharges usually require chemical treatment, and one of the most common problems encountered is the neutralization of acid waste. In the system shown here, lime is used as the neutralizing agent. The waste normally flows to a digester which allows for settlement of solids and serves as a storage center. Flow from the digester to the treatment tank is regulated by a liquid level controller.

The treatment tank is equipped with an agitator which mixes the waste with the lime slurry to provide a neutral solution. The proportion of lime to be added is determined by a recording pH regulator, which operates the control valve on the slurry line and admits the required amount of slurry for neutralization. The slurry is made by admitting quicklime and water to the lime slurry mixer, which is equipped with an agitator. Emergency lines for direct discharge bypassing the treatment system are indicated in the diagram.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation.

Diagram by Huxley Madeheim, Consulting Engineer
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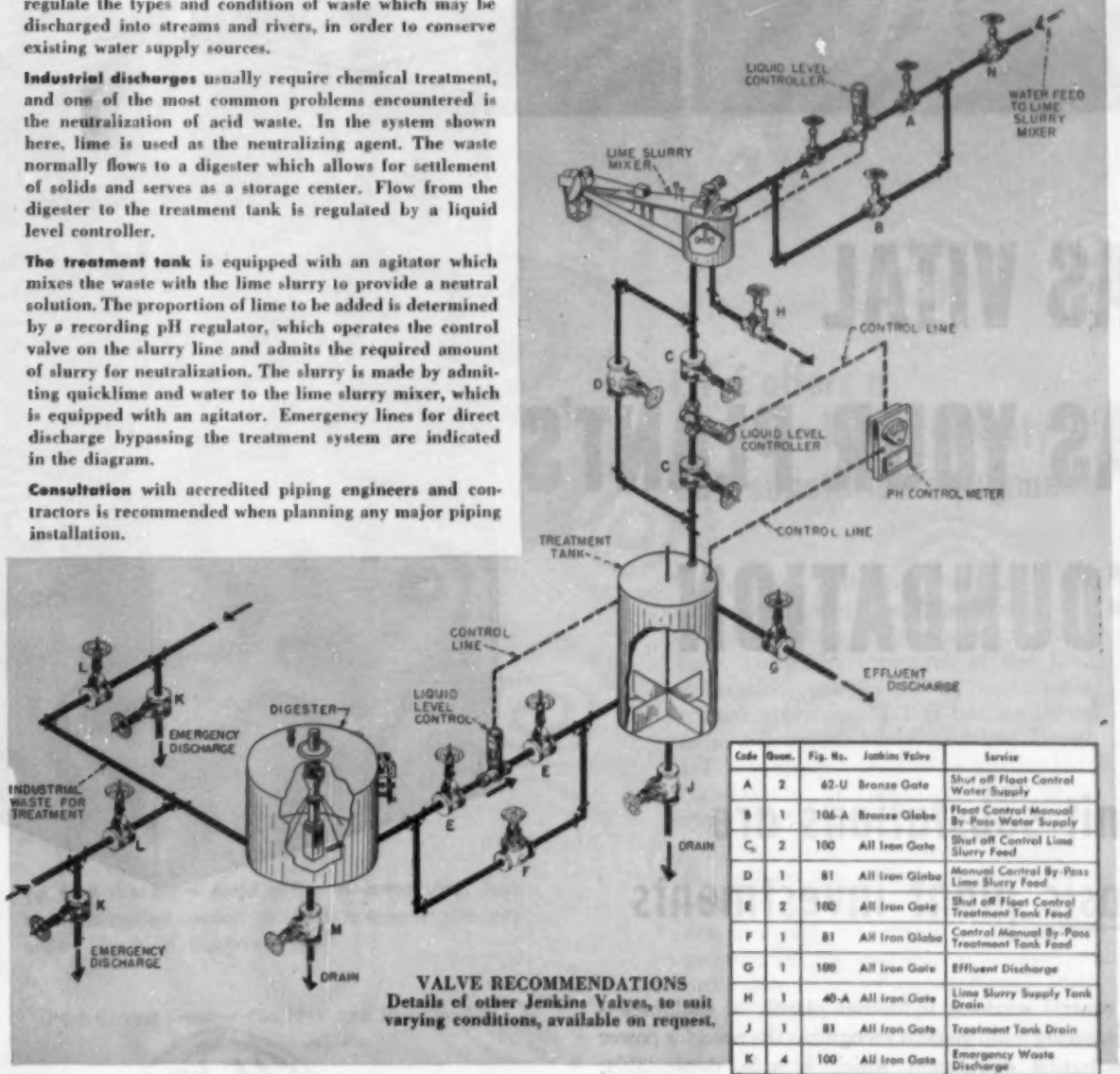

VALVE RECOMMENDATIONS
Details of other Jenkins Valves, to suit varying conditions, available on request.

Code	Quan.	Fig. No.	Jenkins Valve	Service
A	2	62-U	Bronze Gate	Shut off Float Control Water Supply
B	1	106-A	Bronze Globe	Float Control Manual By-Pass Water Supply
C	2	100	All Iron Gate	Shut off Control Lime Slurry Feed
D	1	81	All Iron Globe	Manual Control By-Pass Lime Slurry Feed
E	2	100	All Iron Gate	Shut off Float Control Treatment Tank Feed
F	1	81	All Iron Globe	Control Manual By-Pass Treatment Tank Feed
G	1	100	All Iron Gate	Effluent Discharge
H	1	40-A	All Iron Gate	Lime Slurry Supply Tank Drain
J	1	81	All Iron Gate	Treatment Tank Drain
K	4	100	All Iron Gate	Emergency Waste Discharge
L	4	100	All Iron Gate	Shut off Waste Lines
M	1	81	All Iron Globe	Digester Drain

To simplify planning, to save time, to get all the advantages of Jenkins specialized valve engineering experience, select all the valves you need from the complete Jenkins line. It's your best assurance of *lowest cost in the long run.* Jenkins Bros., 100 Park Ave., New York 17.

Complete description and enlarged diagram of this layout free on request. Includes additional detailed information. Simply ask for Piping Layout No. 70.

SOLD THROUGH LEADING INDUSTRIAL DISTRIBUTORS EVERYWHERE

JENKINS VALVES
LOOK FOR THE DIAMOND MARK

Jenkins Bros.

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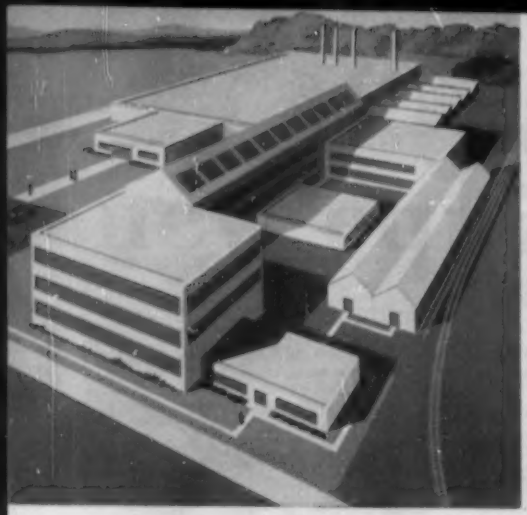

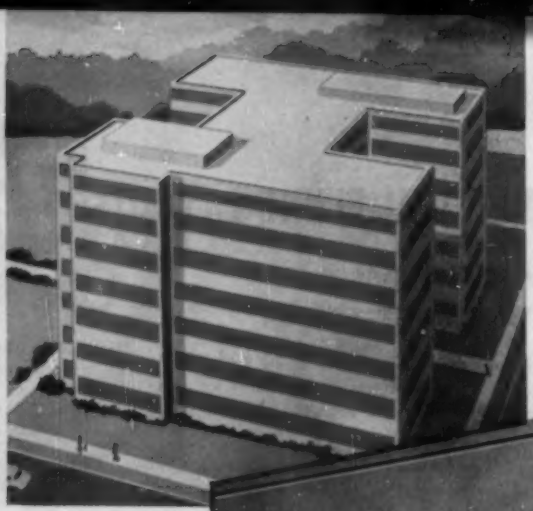

AS VITAL AS YOUR PLANT'S FOUNDATION

unit substations are basic plant investments

In central stations, industrial plants, or buildings—engineering management recognizes the need for power distribution equipment which is safe, dependable, economical, and adaptable. To Unit Substations, forming the *nerve centers* of any distribution system, is delegated the important responsibility of providing continuous power and circuit protection for years to come. Unit Substations, therefore, should not be merely *adequate*, but they must have quality to be a sound, *profitable* capital investment.

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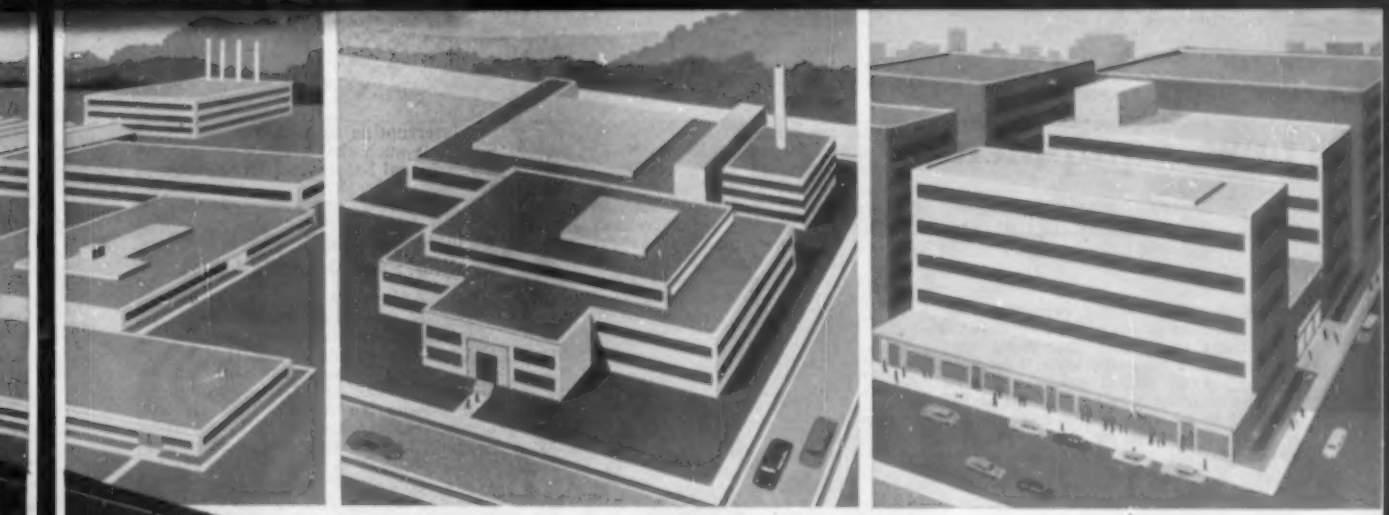
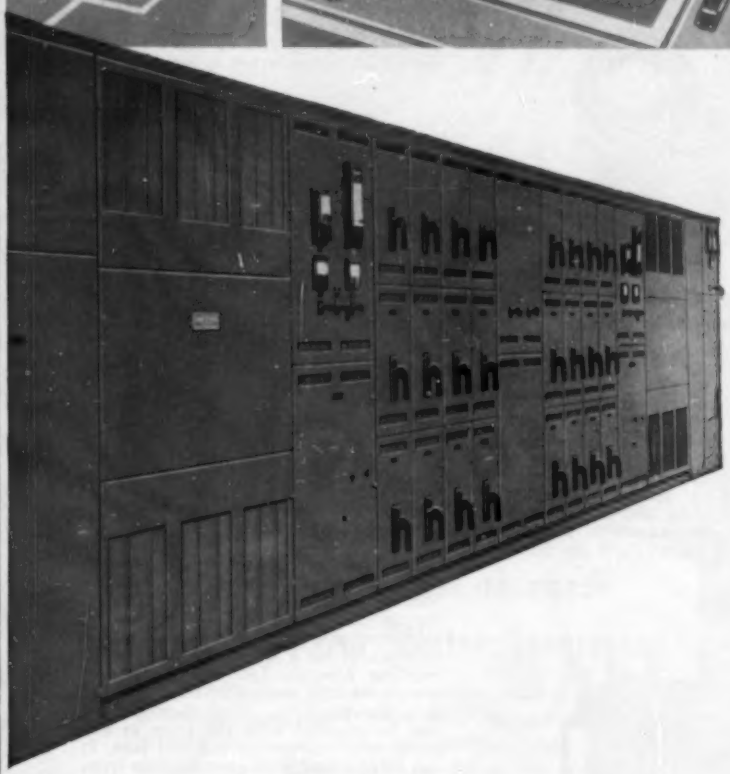




I-T-E offers a complete line of quality unit substation equipment

Through the years, I-T-E has led in the development and manufacture of quality circuit breakers and switchgear. Similarly, since the inception of the Unit Substation, and its use in modern distribution systems, I-T-E has continued to hold this same envied position. Today, I-T-E supplies a full line of quality Unit Substations, in types and sizes to fit every application.

As an *extra service*—to help users make the wisest investment possible—I-T-E furnishes engineering assistance in the selection and application of equipment, preparation of specifications, and coordination of all job requirements. There are I-T-E Application Engineers in every major industrial area for this purpose.

To find the I-T-E field office nearest you, look in the classified section of your telephone directory under "Electrical Equipment."

I-T-E Circuit Breaker Co., 19th and Hamilton Sts. Philadelphia 30, Pa.

UNIT SUBSTATIONS

new equipment

—Starts on page 8

rating. A self-contained adjustment enables the user to match the zero of the transducer to that of the instrument. Any pressure range between 0 to 30 in. Hg and 0 to 10,000 psi is available. Three mounting lugs on the case permit the cell to be mounted in any position or, if desired, directly on the pressure connection. A technical report gives further information.

No bolting necessary with self-leveling mountings

A16 Installing and leveling heavy machinery in minutes—without bolting or shims—is now possible with the series LM3 and LM5 Barrymounts designed by the Barry Corporation. These vibration isolators lift a machine foot to the required height for leveling by a simple turn of the attaching bolt. They permit height adjustments up to ½ in. and carry loads up to 4200 lb per mount. Other models hold from one ounce to 12,000 lb per isolator.

New line of molded oil seals is developed

A17 LPD Clipper Seal is a new design which Johns-Manville has added to its line of all molded oil seals. The lip of the seal contacts the shaft in a thin line around the shaft circumference. This results in minimum seal wear, low frictional heat and less drag (reduced torque) on the shaft. The narrow lip bearing area also reduces the need for lubrication in proportion to its surface. The relationship between the lip area and the hinge area stays proportionately the same throughout the range of flange widths and shaft sizes. A variety of compositions makes the seal adaptable to a wide range of service conditions.

Flow meter has sealed-in Mercoid switch

A18 Development of an improved indicating flow meter is announced by Henszey Company. Said to provide a more accurate control of free-flowing liquids, the meter has only three moving parts. The completely sealed-in Mercoid switch assures protection from dirt, dust, and corrosion and provides a four-way check by visual dial reading and alarm system, lights, or a combination of both. The unit can be installed right on the line.

Oil circuit breakers are of single tank design

A19 Three-phase oil circuit breakers (type G) for 14.4 and 23 kv distribution service are announced by Westinghouse Electric Corp. They utilize a single oil tank to contain all three circuit breaker poles, replacing the former three-tank arrangement. To inspect or service the breaker, all three poles are exposed simultaneously by lowering a single tank. A single housing encloses the solenoid operating mechanism and associated control. Continuous current ratings are available up to 1200 amp with eight-cycle arc interruption up to 250 mva. Frame height is such that all live parts meet the National Safety Code requirements.

Adjustable V-belt available for D and E drives

A20 Adjustable V-belts for D and E drives, manufactured by Manheim Manufacturing & Belting Co., are said to be the easiest V-belt to couple and uncouple ever made. Known as Veelos TD and TE, these link V-belts are made of plys of high-tensile strength canvas duck, joined by riveted studs with removable cup-washers and T-screws. Two types are available: regular rubber coated for general services and oil-proof for oily and high temperature drives.

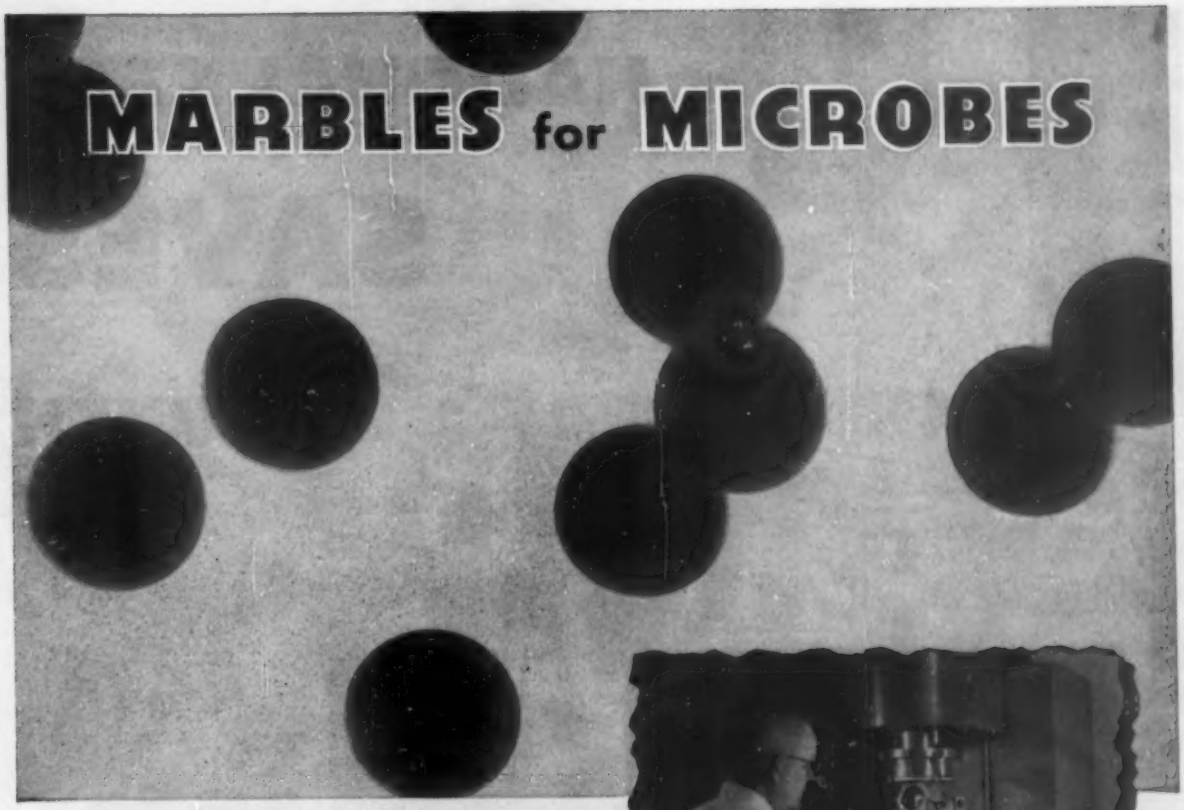
Industrial thermometer is of stainless steel construction

A21 All external parts of a straight form industrial thermometer manufactured by Rochester Manufacturing Company are of stainless steel; the stem and nut are joined into a single unit by a special stainless steel welding process. Instrument surfaces are all smooth, corrosion-resistant, and non-contaminating. This thermometer can be supplied with the stem at any angle with relation to the dial face. It can be obtained with stem lengths from 2½ to 48 in. and covering all standard industrial temperature ranges, from -90 to 1000 F.

Capacitor design is streamlined

A22 The Cornell-Dubilier Electric Corporation's motor starting electrolytic capacitor type EXWCB was engineered to meet the demand for an improved case design—one that would be more compact, streamlined and trim and would mount easily and securely on the motor frame and blend

MARBLES for MICROBES



Above—100,000X enlargement of latex spheres used to calibrate electron microscope in Nalco Laboratories. Actual diameter of spheres is 0.25 microns—.00000975 inches! *Right*—Inserting specimen holder in vacuum chamber of Nalco electron microscope.

. . . How they assist research toward better Water Treatment

PERHAPS even too small to make good marbles for microbes, these tiny spheres help Nalco Scientists in their investigations of the microscopic realms of matter only recently made visible to the human eye by the electron microscope.

Use of the electron microscope in water treatment research is significant because it typifies the continuing efforts of the entire Nalco organization to keep the Nalco System representative of the first and best in all phases of modern industrial water treatment.

If you are not already participating in the economy and efficiency of the Nalco System in your plant, write for details on real water treatment security today.

NATIONAL ALUMINATE CORPORATION
6216 West 66th Place • Chicago 38, Illinois

In Canada: Alchem Limited, Burlington, Ontario

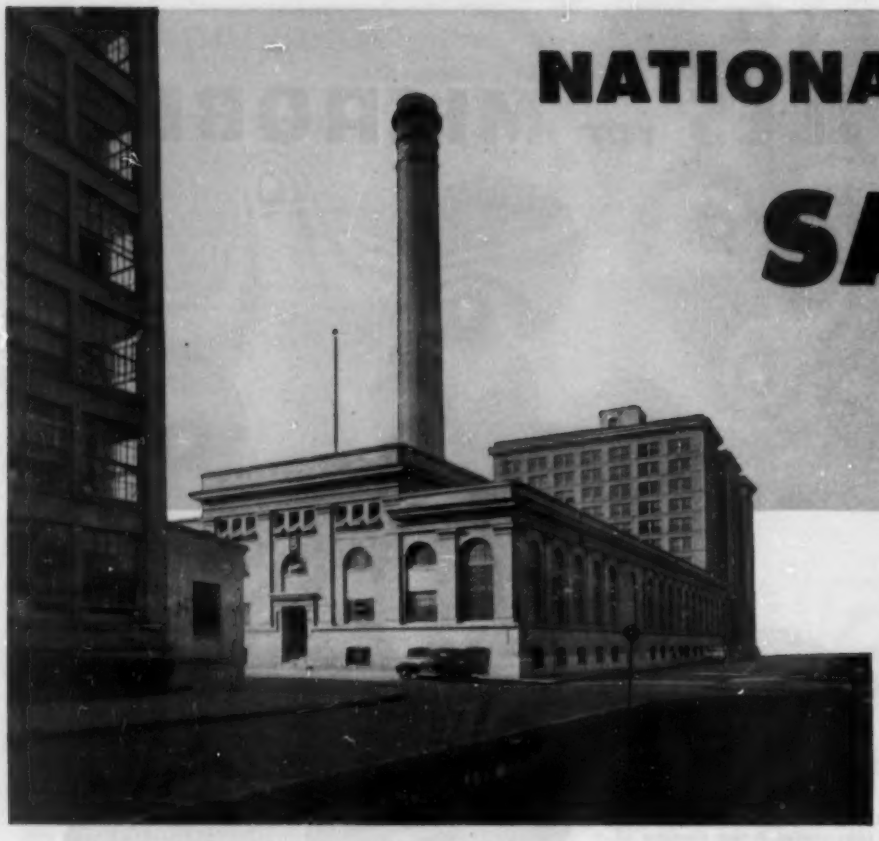
THE *Nalco*®
SYSTEM . . . Serving Industry through Practical Applied Science

Nalco WATER TECHS

New reprint of A.S.M.E. Paper No. 52-A-30: *Experimental Studies of Boiler Tube Metal Temperatures: Effect of Heat Transfer Rate and Deposit Thickness*, gives technical data on high-heat-transfer-rate effects. (140,000 to 300,000 Btu/sq. ft./hr.) at pressures from 250 to 2500 p.s.i. 16 pages, with tables and diagrams. Author: C. Jacklin, Director, Engineering Research, National Aluminate Corporation.

Your Copy Free Upon Request

Circle 507 on Reply Card for more data



NATIONAL CASH SAVES WITH

No smoke nuisance! Located near a beautiful residential area, National Cash Register's steam plant meets strict control regulations by using dust collectors and smoke recorders.

If you operate a steam plant, you can't afford to ignore these facts!

BITUMINOUS COAL in most places is today's lowest-cost fuel, and coal reserves in America are adequate for hundreds of years to come.

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

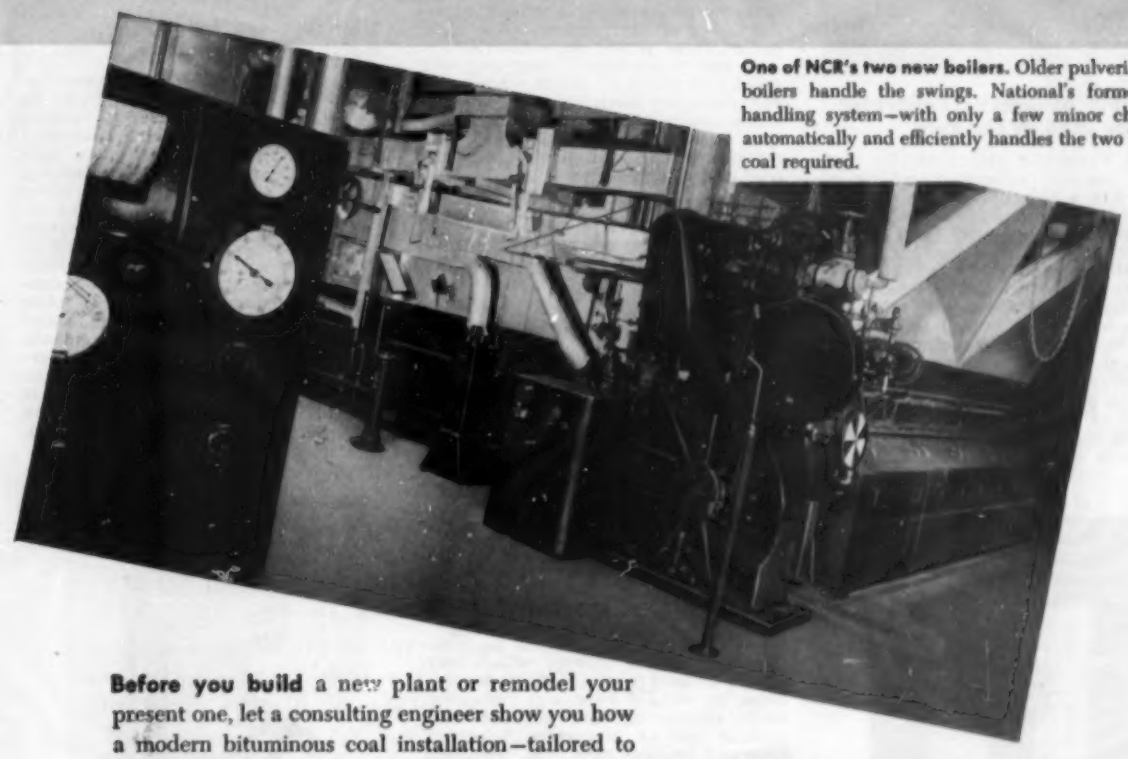
National Cash Register recently installed two modern, stoker-fired boilers in their giant Dayton, Ohio, plant. These boilers supply the major part of the steam NCR uses in generating power for 28 factory buildings and heat for nearly 72 acres of floor space. The savings made have convinced NCR that for high efficiency and low costs, you can't beat an up-to-date bituminous coal-fired installation.

Big loads! Loads in this large plant run up to 300,000 lbs. per hour. The coal consumption runs about 60,000 tons a year.

Additional case histories, showing how other types of plants have modernized and saved money with coal, are available upon request.

FOR HIGH EFFICIENCY
FOR LOW COST

REGISTER
$70,000 A YEAR
MODERN COAL EQUIPMENT



One of NCR's two new boilers. Older pulverized coal boilers handle the swings. National's former coal-handling system—with only a few minor changes—automatically and efficiently handles the two kinds of coal required.

Before you build a new plant or remodel your present one, let a consulting engineer show you how a modern bituminous coal installation—tailored to your needs—can save you money.

With modern coal-burning equipment, you can save from 10% to 40% on steam costs. Automatic coal- and ash-handling systems can cut your labor costs to a minimum.

You're set for the future, too, with coal. Coal reserves are virtually inexhaustible. America's highly mechanical coal industry is the world's most efficient. Thus you are assured of a dependable supply of coal, at relatively stable prices, for years to come.

BITUMINOUS COAL INSTITUTE
A Department of National Coal Association
Southern Building, Washington 5, D. C.

YOU CAN COUNT ON COAL!

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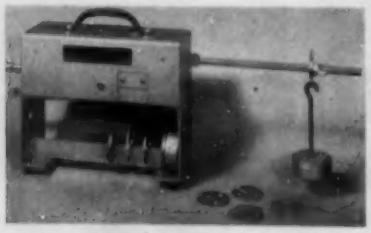
new equipment

—Starts on page 8

neatly into its contour. The entire unit is less than four inches long. An engineering bulletin is available.

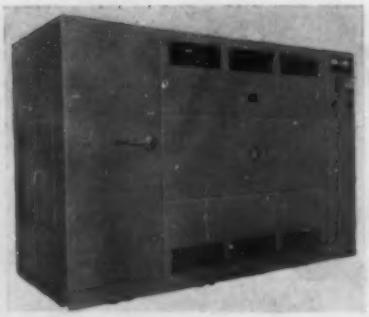


Portable pneumatic calibrator may be used in the field

A23 Pneumatic calibrators for testing and calibrating pressure instruments which operate between 20 in. wg and 25 psig has been developed by Republic Flow Meters Co. Performing the same function as an air loader, the calibrator may be adjusted accurately to produce any pre-determined pressure by adding or removing calibrated weights from a weighbeam. The slow process of setting output pressures with a manometer is not necessary. The instrument is fully portable, permitting its use in the field as well as in the shop. The calibrator operates from a 35 psig air source. Literature is available.

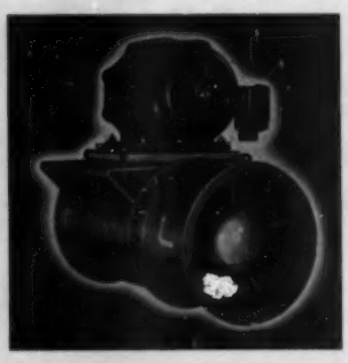
Stainless steel float trap designed for corrosive duty

A24 Float traps made entirely out of stainless steel have been developed by the V. D. Anderson Company for draining corrosive liquids from air, gas, and steam confined in piping systems and equipment. These automatic traps drain liquids as fast as they are formed, continuously, without permitting the escape of air or gas. They are designed for 300 lb pressure and maximum total temperature of 800 F in sizes ½ to 2 in.



Transformer features built-in forced draft equipment

A25 The Marcus Transformer Company's unit load center, 2000 kva transformer features built-in automatic forced draft equipment to increase capacity under overload conditions. Rating is: primary, 4800 v, 60 cycles, three phase; secondary, 480 v. The unit is packaged complete with fused load break air switch on primary and secondary metering, with pull section-primary switch handle and access door interlocked for safety. All Marcus transformers feature class B hi-dielectric, hi-heat magnet wire.

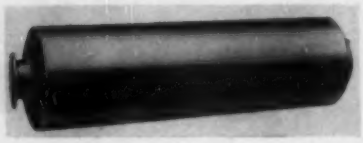


Modification of standard blower is used for high temperatures

A26 Vaneaxial blowers which may be used to move air at temperatures up to 350 F or air containing acids, alkalies or fine abrasive dust without fear of premature failure of belts and bearings have been developed by the Hartzell Propeller Fan Company. A modification of the standard belt-drive vaneaxial blower, these blowers are available in the same range of sizes: 12 to 54 in. There is said to be no loss of efficiency and air deliveries are the same as for standard models. The complete removal of the vulnerable parts from contact with the destructive elements in the airstream insures long life and trouble-free operation under adverse conditions.

Demand meter records and warns

A27 For engineers in industrial plants who would like to have a visible or audible warning when the plant load is climbing to a new demand rate-change point Westinghouse has developed a demand meter that both records and warns. The recording instrument commonly used to measure kva demand (type RI) employs the mechanical principle of a ball to summarize vectorially the disc speeds of the two meter elements. Addition of a warning device to this mechanism would introduce friction that might make the ball slip. A light beam is frictionless. This fact, with an electronic amplifier, is being put to work in the demand meter to enable it to give the desired warning without interfering with the measuring and recording.



Silencers are for moisture-free air uses

A28 Two new series of silencers for quieting the noise produced by air compressors, blowers, vacuum pumps, and other machines expelling high velocity air to atmosphere have been developed by Burgess-Manning Engineers. To be known as the series CA and LCA, they are designed for operation under moisture-free air conditions and for temperatures up to 200 F. Both series are absorption type silencers employing straight-through acoustically transparent perforated tubes surrounded by a deep layer of sound absorbing material. Special sound absorbing material can be used for operation at higher temperatures than the standard of 200 F. The CA Series is available in pipe sizes up to 6 in., the LCA Series in sizes larger than 6 in. Literature is available.

Sump pump features positive priming without venting

A29 Designed for portable or stationary service, Penberthy Injector Company's automatic electric submersible sump pump with 1-¼ in. discharge, has a capacity of 2200 gals per hr at a discharge head of 10 ft. It pumps 400 gals per hr at 24 ft head. Operating on continuous or intermittent duty, the pump features positive priming without venting. No complicated adjustment is required. Only 12½ in. high, it occupies a 10 in. dia space and weighs 40 lbs. While automatic starting and stopping levels are 8 and 2 in. above sump bottom, by simply removing the top electrode tip, automatic

. . . is as individual as a fingerprint. No two problems are alike and there is no standard solution. However, with a comprehensive engineering approach and application of selected anti-foam agents, even an extremely difficult problem can be overcome.

To illustrate the point, a steel mill boilerhouse operating on 100% make-up water, produced 6,000,000 pounds of steam daily to operate its turboblowers. Continuous carryover of boiler water solids with steam was encountered. Regulators and valves were coated with heavy deposits. Frequent slugs of water passed through the superheaters into the turboblowers. And, the superheater temperature charts literally resembled a picket fence!

Betz Engineers recommended the application of proper anti-foam agents and effected a remarkable improvement. Carryover has been *eliminated*, and superheater temperature has been *increased* approximately 50 degrees.

Why not ask a Betz Engineer today to explain how anti-foam agents can help solve your own particular carryover problem and save you time, money and effort in your plant? Ask him too, about the complete Betz *Specialized* Water Conditioning Service tailor-made to your needs. W. H. & L. D. BETZ, Gillingham and Worth Streets, Philadelphia 24, Pa. In Canada: BETZ Laboratories Limited, Montreal 1.

Betz Technical Paper 115 "Carryover Prevention With Anti-Foam Agents" is free for the asking. Write for a copy today.

BETZ

CONSULTANTS ON ALL WATER PROBLEMS

Circle 509 on Reply Card for more data

Combined trip-throttle valve permits operator to throttle steam directly into G-E Type DP Mechanical-Drive Turbine, usually eliminating need for extra valve in steam line.

ANOTHER PLUS VALUE OF G-E MECHANICAL-DRIVE TURBINES...

Combined Trip-throttle Valve Cuts Turbine Installation Costs

To save you the cost both of buying and installing a throttle valve in the steam line, General Electric designed into its standard Type DP mechanical-drive turbine a trip valve which also functions as a throttle valve. This feature alone can save you up to $200.00 at time of installation.

The combined trip-throttle valve controls steam admission to the turbine on starting and also shuts off all steam in case of overspeed. No need in most cases to shut off steam valves ahead of the turbine before restarting the unit. The combined trip-throttle valve can quickly be reset and the turbine put back on the line, saving you time in an emergency.

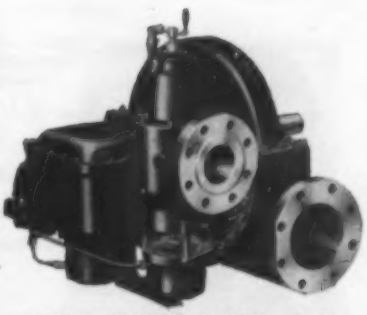
THIS COMBINED TRIP-THROTTLE VALVE is just one of many DP features which save you money. The chart below indicates other areas of savings.

Remember—the total cost is often more than just the sales price. But G.E.'s standard DP turbines include the extra features to save you extra costs. For more information contact your nearest G-E apparatus sales office. Write for bulletin GEA-4955A, "A New Standard in Mechanical-drive Turbines." General Electric Company, Schenectady 5, N. Y. 252-63

GENERAL ELECTRIC

INSTALLATION AND MAINTENANCE COST-SAVING FEATURES

THESE EXTRA FEATURES, STANDARD ON ALL G-E TYPE DP TURBINES, CAN . . .	Save You up to
COMBINED TRIP-THROTTLE VALVE Eliminate extra cost of buying and installing valve ahead of the turbine.	$200.00
SINGLE RESERVOIR FOR COOLING LUBE OIL Eliminate extra cost of piping cooling water to and between bearings.	50.00
MAJORITY OF PARTS INTERCHANGEABLE One set of spare parts protects several units—less money tied up in inventory.	100.00
METALLIC-LABYRINTH VALVE STEM BUSHING Eliminate labor costs of replacing soft packings; cut down-time production losses.	50.00
SHAFT MONEL-SPRAYED AT PACKING FIT Saves frequent cost of purchasing and installing carbon rings; contributes to long shaft and packing life.	20.00
ESTIMATED TOTAL SAVINGS	$420.00



G-E Type DP Mechanical-Drive Turbine

COMPARE THE FEATURES
EVALUATE ALL THE COSTS

See why G-E standard Type DP turbines are your most economical buy.

Circle 510 on Reply Card for more data

new equipment

—Starts on page 8

starting level is increased to 20 in.: a desirable feature when pump has to operate too often.

Unit heater motor mount includes safety guard

A30 L. J. Wing Manufacturing Co. has announced a new type of construction on certain sizes of the Wing Utility Unit Heater, a horizontal discharge heater, as well as on the suspended, vertical discharge Wing Revolving Unit Heater. The feature of this construction lies in combining the motor mount with an integral safety guard. The result, it is claimed, is a more rigid type of motor mounting and more strength in the safety guard. A bulletin is available.

Float and thermostat traps added to line

A31 The 50 Series float trap, manufactured by Hoffman Specialty Manufacturing Corp., uses just a float mechanism and is for removing condensate only when there is no air problem involved. In addition to the float mechanism, the 50 Series float and thermostatic trap has a thermostatic element, pin, and seat so that the trap and connecting piping cannot become air bound. The thermostat assembly is factory set and sealed and is available for low or high pressure traps.

Low pressure joint added to fitting line

A32 Type LPR ball bearing swivel fitting manufactured by Emsco Manufacturing Company is designed for a maximum pressure of 1000 psi at a maximum temperature of 225 F. Packing materials, including Teflon for corrosive service, are independent of the ball rows and are unaffected by ball race wear. Packings can be replaced and adjustments made for normal wear while the fitting is in service. A catalog is available.

TO REQUEST ADDITIONAL DATA

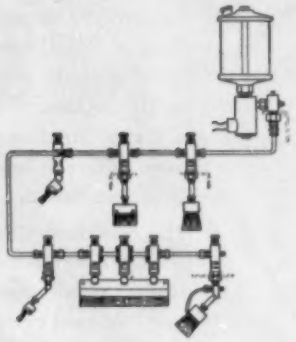
Circle "key" numbers on Reply Card between pages 36/37 & 92/93. Your requests will be handled promptly.

Gas unit heaters are completely self-contained

A33 Warren Webster & Company has announced a gas unit heater in seven basic models: capacity 25,000 to 200,000 Btu heat input. All units carry the approval seals of the American Gas Association and the Underwriters' Laboratories. The completely self-contained automatic units can be used with natural, manufactured, mixed, or LP gas. Burners, orifices, and controls are varied according to the characteristics of the gas to be used. A bulletin gives full details.

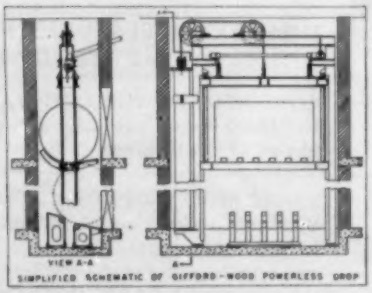
Valve works independently of speed governor

A34 An excess speed safety stop valve has been developed by Coppus Engineering Corporation for its line of steam turbines. This improved stop valve functions entirely independently of the constant speed governor and eliminates the usual levers between safety trip mechanism and shut-off valve. The valve stem no longer protrudes outside the valve body, a new design feature that prevents stickiness due to boiler compound or other foreign matter in the steam. Complete enclosure of the valve eliminates accidental damage from outside. It can be incorporated in the old style valve bodies.



Oiling system is simple to operate

A35 The chain oiling system developed by Oil-Rite Corporation is designed to lubricate a number of individual chains or the sides of chains. The system consists of a central oiler which feeds one or more valve brush assemblies connected in series by means of copper tubing. Reservoirs for the oilers are available in six sizes, from nine ounces to one gallon in Lucite, or in glass for temperatures above 160 F. Literature is available.



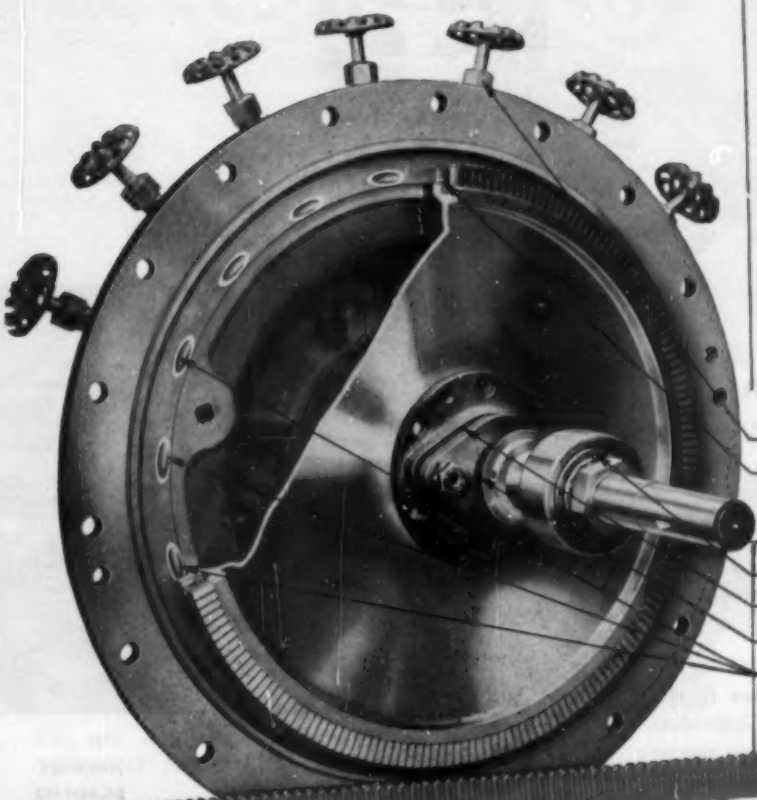
Powerless drop takes minimum floor space

A36 A powerless drop, manufactured by the Gifford-Wood Company, mechanically lowers cylindrical loads from one floor to another and discharges them automatically. Typical loads handled include drums, barrels, rolls of cloth, rolls of rubber, sectional beams, and rolls of paper. Principle advantages are: (1) no power is required for its operation, (2) being vertical it requires a minimum of floor space, (3) there is no problem of slowing down and stopping the load as in the case of inclined chutes, and (4) virtually no maintenance is required as

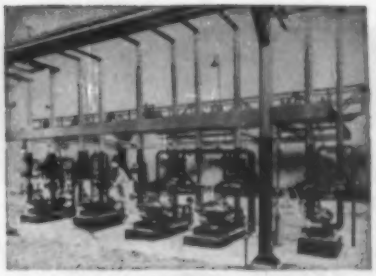
No other steam turbine offers you

SUCH VERSATILE STEAM NOZZLE CONTROL

The larger number of hand valves you see on a Coppus Steam Turbine promises you greater operating economy. At least 60% of the steam nozzles can be individually controlled to give maximum steam pressure in steam chest . . . a guarantee of best water rates at any load. Maintenance economy, too, is assured by the hard chromium plating of the shaft at the stuffing box. It provides the best possible smooth, non-corrosive surface for packing rings.



- 7 hand valves for efficient partial load operation, (20" turbine shown)
- 2 row velocity-stage turbine wheel with stainless steel turbine buckets — statically and dynamically balanced
- 30-40 carbon steel shaft
- Oversized double row deep grooved ball bearing
- Stuffing box with metallic packing ring
- Heavy chrome plating of shaft through stuffing box
- 3 nozzles always open



Coppus Steam Turbines, Type TF, driving chemical transfer pumps at Celanese Corporation of America's Chemcel Plant

Coppus Steam Turbines ranging from 150 hp down to fractional in 6 frame sizes

MAKE TURBINE DOLLARS GO FARTHER

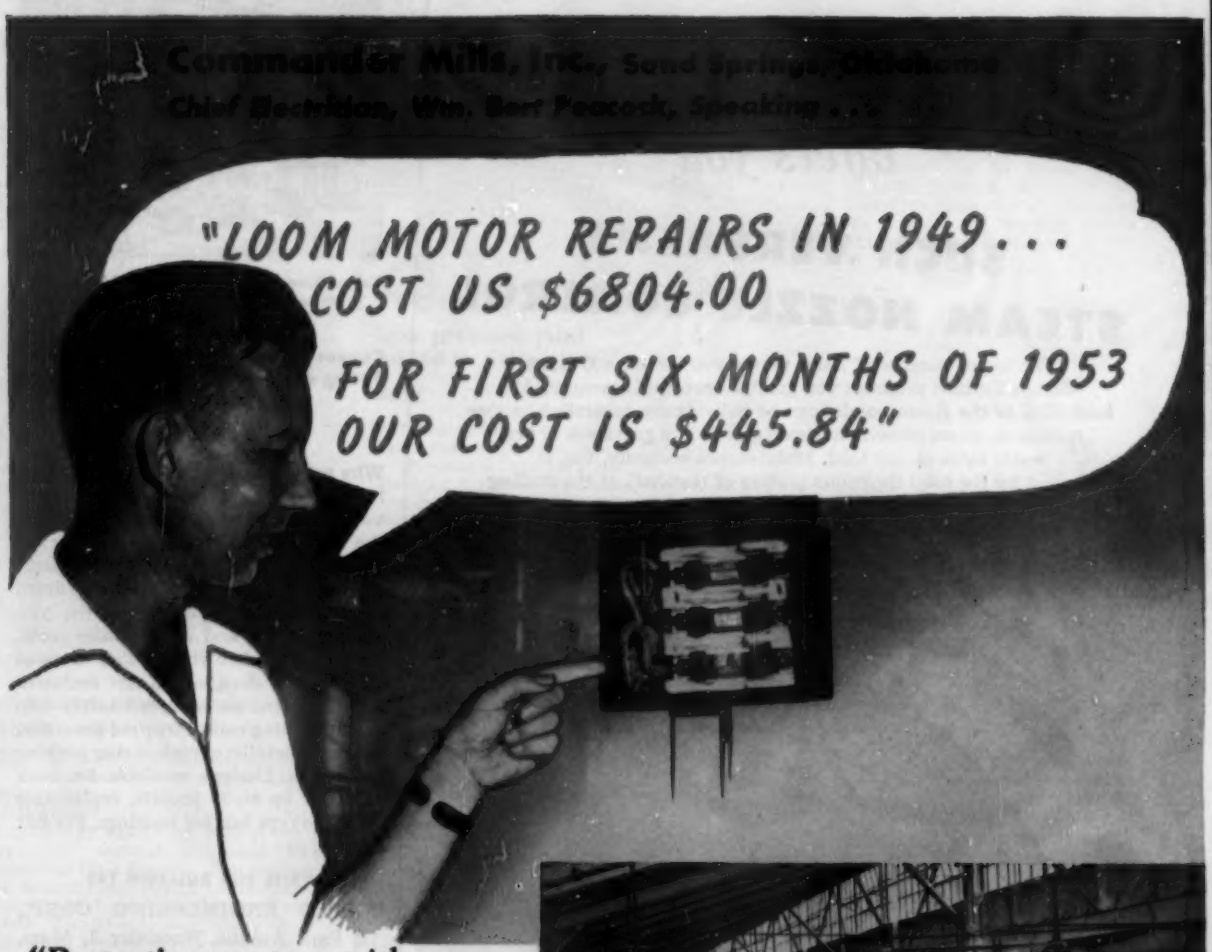
Why waste money buying turbines with higher horsepower ratings than you need? The higher the horsepower rating, the higher the price. Save money by selecting the Coppus Turbine size closest to your requirements from 150 hp down to fractional. And when you do, you save operating and maintenance costs, too. That's what these other Coppus features are designed to do: exclusive pilot operated excess speed safety trip supplementing constant speed governor; choice of metallic or carbon ring packing assemblies. Designs available for back pressures up to 75 pounds; replaceable cartridge type bearing housings. For full details . . .

WRITE FOR BULLETIN 135

COPPUS ENGINEERING CORP., 181 Park Avenue, Worcester 2, Mass. Sales offices in THOMAS' REGISTER.

COPPUS "BLUE RIBBON" TURBINES

Circle 511 on Reply Card for more data



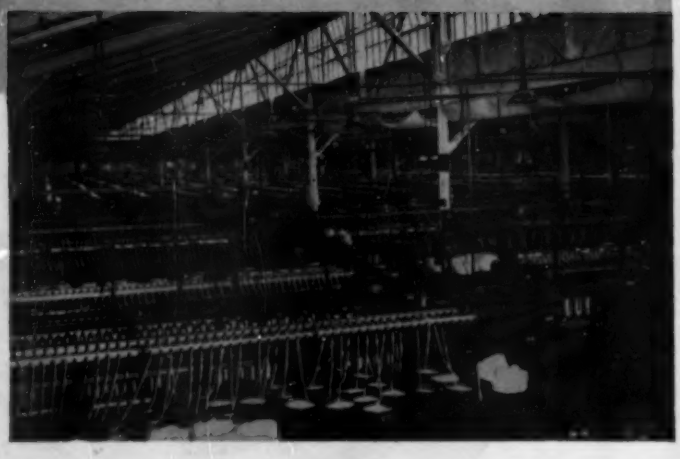
"Protecting motors with FUSETRON fuses is saving us about $6000.00 per year."

"We have a thousand looms, 90 of which are powered by 1 hp motors, 180 by 1½ hp, 100 by ½ hp, 630 by ¾ hp. Prior to 1949 several hundred of these were rewound each year. In fact, they carried them out by the truck loads to the motor rewind shop.

We started using Fusetron Fuses in the winter of 1949 and began to keep individual records on motors. The reduction on motor burn-outs was immediately noticeable. In 1950 only 44 loom motors were repaired.

There is no way to know how much damage was done to motors prior to our new system of maintenance, and it is my belief that some motor repairs now are due to partial damage done prior to 1949.

"In the entire plant we have over 2,500 motors, representing a little more than 5,000 hp connected load. The following list shows our actual expenses on motor repairs:"



"YEAR OF REPAIRS	NUMBER OF MOTORS	AMOUNT
1949	(No Record Kept)	$6,804.00
1950	87	2,796.20
1951	59	2,640.44
1952	63	2,165.63
1953 (1st 6 mos.)	23	445.84

	NUMBER OF MOTORS	DATE OF REPAIRS	AMOUNT
BREAKDOWN OF RECORD FOR MOTOR REPAIRS FOR PAST 6 MONTHS:	3	JAN.	$ 76.37
	4	FEB.	88.62
	3	MAR.	70.62
	4	APRIL	87.75
	4	MAY	101.86
	2	JUNE	20.62
			$445.84"

Commander Mills, Inc., Sand Springs, Okla.
Superintendent W. R. Swafford, *in charge of Manufacturing, says:*

"WE AVOID UNNECESSARY SHUTDOWNS AND PREVENT MOTOR BURNOUTS BY USING FUSETRON FUSES"

"In the sewing room we have 70 machines using ½ hp, 3-phase motors.

"They are all equipped with Fusetron fuses rated at 3.2 amperes. Formerly, we used 30 ampere fuses to avoid unnecessary blowing on the starting surges of the machines.

"The Electrical Department installed these smaller Fusetron fuses several years ago, and we have not had any trouble with blowing them needlessly and neither have we had any motor burnouts.

"We believe it better to blow a fuse than burn out a motor!"

You too, can profit by the 10 POINT PROTECTION of FUSETRON dual-element FUSES

1. *Protect against short-circuits.
2. Protect against needless blows caused by harmless overloads.
3. Protect against needless blows caused by excessive heating — lesser resistance results in much cooler operation.
4. Provide thermal protection — for panels and switches against damage from heating due to poor contact.
5. Protect motors against burnout from overloading.
6. Protect motors against burnout due to single phasing.
7. Give DOUBLE burnout protection to large motors — without extra cost.
8. Make protection of small motors simple and inexpensive.
9. Protect against waste of space and money — permit use of proper size switches and panels.
10. Protect coils, transformers and solenoids against burnout.

*Fusetron Fuses have high interrupting capacity as shown by tests of the Electrical Testing Laboratories of New York City in December 1947.

FOR MORE INFORMATION *use this Coupon*

FUSETRON is a trademark of the Bussmann Mfg. Co., Division of McGraw Electric Co.

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

BUSSMANN Mfg. Co. (Division of McGraw Electric Co.)
University at Jefferson, St. Louis 7, Mo.

Please send me complete facts about FUSETRON dual-element Fuses.

*Name*_____

*Title*_____

*Company*_____

*Address*_____

*City & Zone*_____ *State*_____ 106

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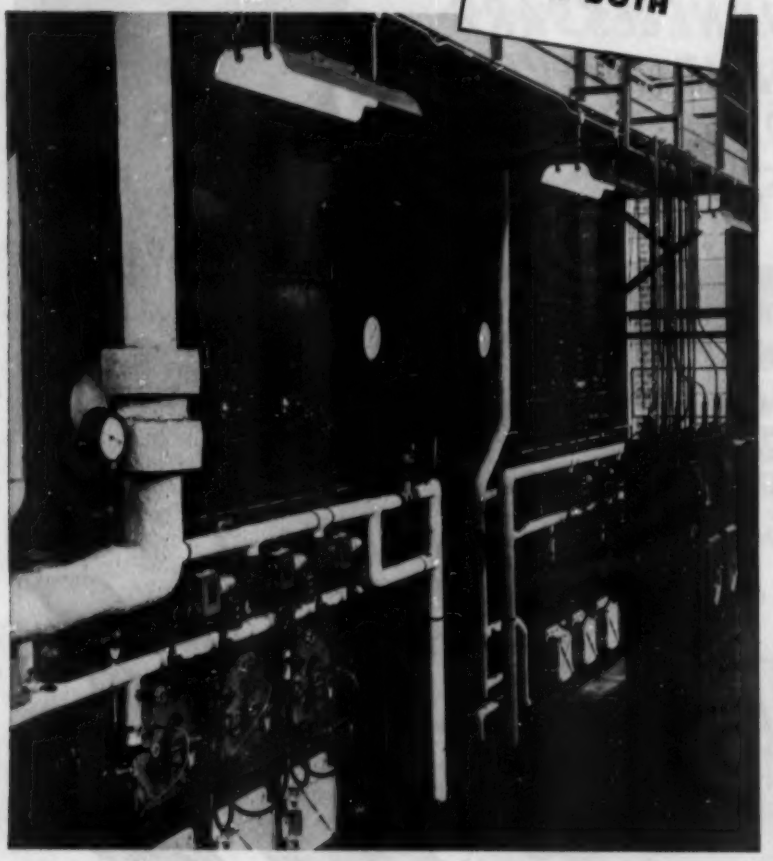
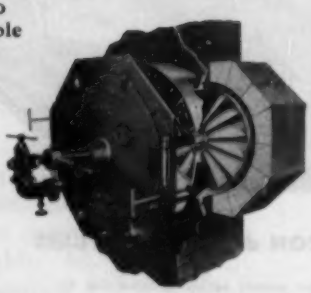
ENCO BURNERS

FOR OIL, GAS OR BOTH



This New England textile mill uses Enco Type K oil burners. When gas is available a gas-burner gun can be added for dual fuel firing.
Combustion in any case is uniform even if steam demands fluctuate suddenly—another economy feature.
This is only one example of economy with Enco Burners—made in sizes and types for every power plant need, including those with very wide load swings. Ask for literature or a special recommendation for your specific, individual oil or gas burner needs. We will give it the benefit of 35 years' experience in solving unique burner problems.



Enco type K oil burning unit

EC-489

THE ENGINEER COMPANY
75 WEST STREET, NEW YORK 6, N. Y.
IN CANADA: ROCK UTILITIES LTD., 80 JEAN TALON ST. W., MONTREAL, P. Q.

Circle 513 on Reply Card for more data

new equipment

—Starts on page 38

compared with most mechanical conveyors. It is installed in a shaftway and operated on a simple counterweight principle.

Blower is designed for extra-wide boiler furnaces

A37 For cleaning extremely wide boilers where the blower nozzle must travel more than 25 ft, Diamond Power Specialty Corp. announced the Model TT Blower. Among its important features are the rigid truss construction for simple support and step-tapered lance for minimum deflection. An auxiliary carriage supports the feed tube and the drive shaft in the extended position. A single stationary motor mounted at the boiler end both propels and rotates the lance tube through a close-pitched blowing pattern for high-intensity and uniform cleaning. Diamond Power Specialty Corp.

TO REQUEST ADDITIONAL DATA

Circle "key" numbers on Reply Card between pages 36/37 & 92/93. Your requests will be handled promptly.

Continuous operation is possible while removing thermocouples

A38 Conax Corporation's C-U-P Gland permits changing exposed wire thermocouples without reducing pressure on the system. This allows continuation of operations while removing and replacing burned out thermocouples. It is basically a Conax Thermocouple Gland equipped with an open and protection tube, a special Conax Packing Gland, and a gate valve. The glands are said to be capable of sealing several thousand

LOW COST

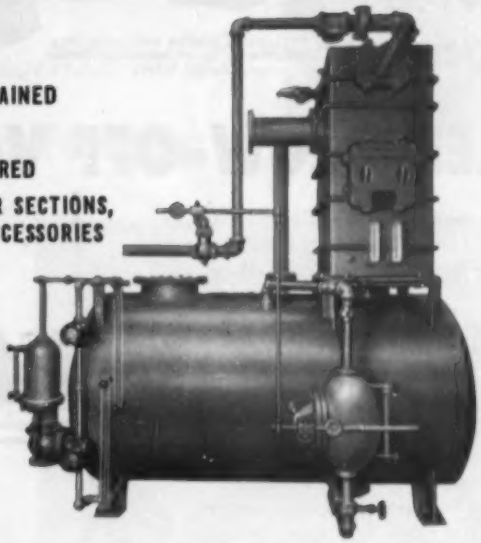
High Efficiency Deaeration

FOR SMALL AND MEDIUM SIZE POWER PLANTS

COCHRANE

UNI-PAC* DEAERATOR

- FACTORY ASSEMBLED
- COMPLETELY SELF-CONTAINED
- EASY TO INSTALL
- MINIMUM PIPING REQUIRED
- WIDE RANGE OF HEATER SECTIONS, STORAGE TANKS AND ACCESSORIES TO MEET ANY PLANT REQUIREMENT
- GUARANTEED ZERO OXYGEN



Here's the deaerator every small and medium-size plant has been waiting for!

Now for the first time you can get a ready-to-install deaerator that will give you high quality boiler feedwater at extremely low cost. The UNI-PAC DEAERATOR is guaranteed to deliver water with an oxygen content not to exceed 0.005 c.c. per litre (less than 7 p.p. billion)—generally recognized as zero oxygen!

The UNI-PAC DEAERATOR is designed for both right and left hand installation, and in a wide range of outlet and storage capacities. Accessory equipment is available to meet operating conditions peculiar to the plant and to obtain the results desired.

Publication 4643 contains complete details. Write today for your copy.

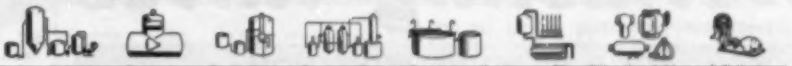
*Trademark

COCHRANE CORPORATION WATER ENGINEERS FOR 91 YEARS 1863 - 1954

cochrane

corp. 3108 N. 17th Street, Philadelphia 32, Pa.

Representatives in principal cities in U.S.A. In Canada, Mexico, Paris, Cuba, Venezuela, Puerto Rico, Hawaii.



Hot Process Softeners • Deaerators • Deaikalizers • Demineralizers • Reactors • Continuous Blow-Off • Specialties • C-B Systems

Circle 514 on Reply Card for more data

These EVERLASTING advantages give better service from

Fig. 4001/6561. Duplex unit consisting of Straightway Lever-operated Valve and Angle Valve.

BOILER BLOW-OFF VALVES

When you install an EVERLASTING Duplex Blow-Off Unit, you'll find that its many superiorities speak for themselves.

The valve at the left is the EVERLASTING design that has been famous for more than 40 years . . . the valve with the drop-tight seal that actually improves with use because of its self-lapping action each time the valve is opened or closed . . . the valve that can't stick or jam because of its non wedge design . . . the valve that opens in less than a quarter turn to provide unimpeded straight-through blow.

The valve at the right is the equally famous EVERLASTING Angle or "Y" Valve, specially designed and equipped to withstand repeated blow-off shocks, erosion and corrosion, and without pockets that might trap and hold solids.

Each of these valves . . . and all the other EVERLASTING Boiler Blow-Off valve types, fully meet ASME code requirements . . . assurance that they are properly designed and amply strong for the service.

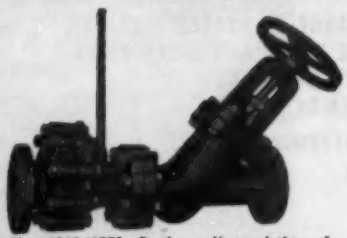


Fig. 4001/6571. Duplex unit consisting of Straightway Lever-operated Valve and Y Valve.

Fig. 6571/6561. Duplex unit consisting of Y Valve and Angle Valve.

Fig. 6561/6571. Duplex unit consisting of Angle Valve and Y Valve.

Write for descriptive bulletin

EVERLASTING VALVE CO.
41 Fisk Street, Jersey City 5, N. J.

Everlasting Valves

TRADE MARK "EVERLASTING" REG. U.S. PAT. OFF. EV-540

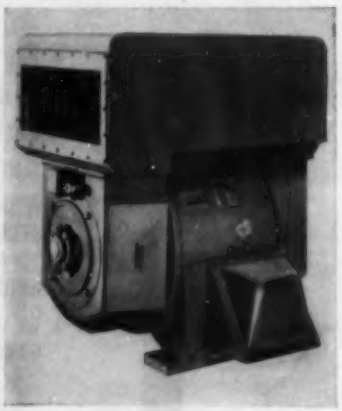
FOR EVERLASTING PROTECTION

Circle 515 on Reply Card for more data

new equipment

—Starts on page 8

pounds per square inch but, in operation, are normally limited to about 500 psi by the force required to slide the protection tube into a pressurized system. Temperature range is determined by the sealant selected for both the thermocouple gland and packing gland parts. The glands are available for use with 14 or 20 gage thermocouple wires.



Unit-cooled d-c motors feature greater heat transfer

A39 Totally-enclosed, unit-cooled, d-c motors for use in severe atmospheres have been announced by the General Electric Company's Direct Current Motor and Generator Department. The smallest standard model of its type, it was developed for application in machine-tool, paper, cement, chemical, rubber, and steel-mill industries, and for materials-handling operations. Available in ratings from 15 to 200 hp, it is said to provide 50 percent greater heat transfer in a 37 percent smaller unit than previous designs. Compact cooling units, mounted completely within the over-all length and width of the motors, permit operation at extremely low speeds for long periods of time because ventilation is independent of motor speed. The blower motors, standard G-E totally enclosed type, are for 3-phase, 60-cycle power supply. The new motors are available in the same speed and horsepower ratings as standard, constant, or adjustable-speed, general purpose motors.

Pipe insulation is for use on hot or cold water lines

A40 Low pressure pipe insulation for use on cold water, hot water, or low pressure steam lines, has been announced by Owens-Corning Fiberglas Corp. Due to its extra heat-

Wagner
TRANSFORMERS
...the choice of leaders in industry

Meet changing load demands with

Wagner Dry-Type Transformers

Wagner dry-type transformers can solve your problems by putting the right voltage close to the load wherever machines, portable tools or lights require voltage changes.

SAFE- Wagner dry-type transformers meet all requirements for indoor installation. They will save you money on insurance premiums. Fireproof vaults or other special protection are unnecessary—even where fire hazards are present.

ECONOMICAL- when you use Wagner dry-type transformers, you reduce installation costs—you reduce line losses—you eliminate long runs of secondary copper—and you can forget about maintenance.

COMPACT- Wagner dry-type transformers are small in size—light in weight—easy to install and easy to move whenever changes in plant facilities make it necessary.

Wagner general-purpose dry-type transformers are available in single-phase units, 600 volts and below, in sizes 1, 1½ and 2 kva—55° C Rise; and in sizes 3 to 100 kva—80° C Rise. Write for Bulletin TU-57.

Unit Substation Transformers

for load-center power distribution

Wagner three-phase dry-type load-center transformers are built in ratings through 2000 kva in the 15-kv class and below. Transformer and incoming line section are housed in compact factory-matched enclosures, designed for direct connection to matching secondary switchgear to form a closely coupled unit substation that is streamlined in appearance and readily accessible. Complete enclosure of all equipment assures safety against contact with live parts.

Bulletins TU-56 and TU-13 give full information on Wagner Dry-Type and Liquid-Filled Substation Transformers. Write for your copies.

Wagner Electric Corporation EST. 1891

WAGNER ELECTRIC CORPORATION
6429 PLYMOUTH AVE., ST. LOUIS 14, MO., U.S.A.

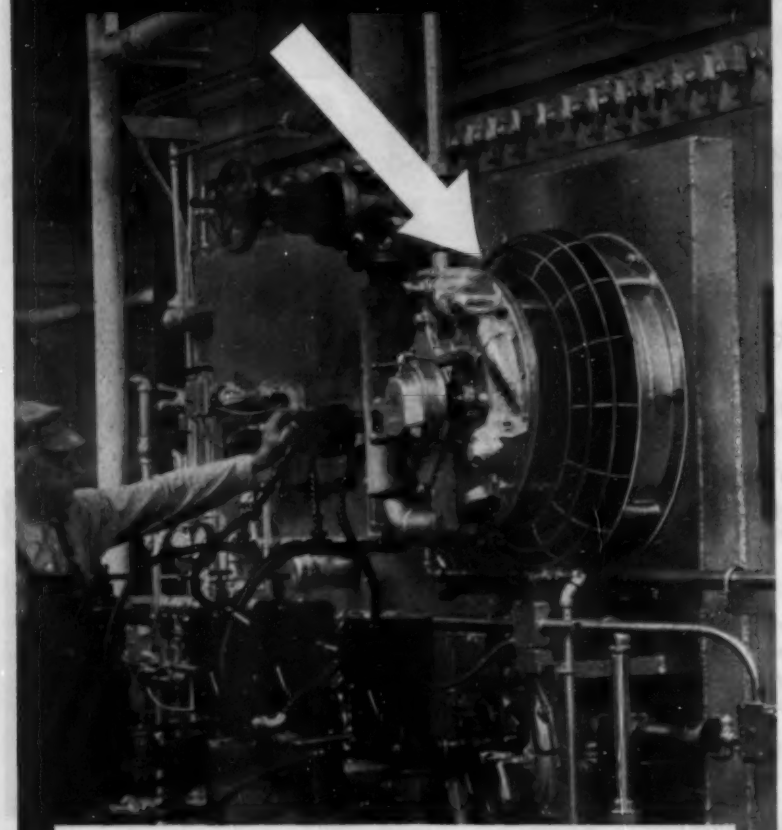
BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

ELECTRIC MOTORS
TRANSFORMERS
INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

T54-1A

Circle 516 on Reply Card for more data

Only a WING Axial Flow Turbine Blower would permit such a compact installation



THIS neat, compact forced draft installation shows how the WING Axial Flow Turbine Blower can save thousands of dollars in installation costs by eliminating the duct work and excavation costs attendant on the use of other types of blowers. This compact, quiet, low-speed blower delivers 11,300 CFM at 3" static pressure to the 40,000 lb. per hr. B & W oil-fired boiler at the Chicago plant of Southern Cotton Oil Co., makers of the well-known Wesson Oil. This is the third Wing blower at the Chicago plant, the tenth in all Southern Cotton Oil plants, the first having been installed in 1916.

Wing

L. J. Wing Mfg. Co.

139 Vreeland Mills Road
Linden, N. J.
Factories:
Linden, N. J. and Montreal, Can.

Circle 517 on Reply Card for more data

new equipment

—Starts on page 8

stopping value, a ½-in. thickness of the insulation is said to equal the performance of ¾ to 1-in. thicknesses of other materials commonly used in the low pressure field. Available with a canvas covering for installation on hot water or low pressure lines and with a black jacket of asphalt saturated kraft paper to protect against condensation on cold water lines, it will stand up under long service because the inert fibers of glass will not rot or corrode. The material will not shrink, buckle or sag under changes in temperature and humidity. Primarily for indoor applications, addition of a waterproof jacket makes it suitable for outdoor use.

TO REQUEST ADDITIONAL DATA

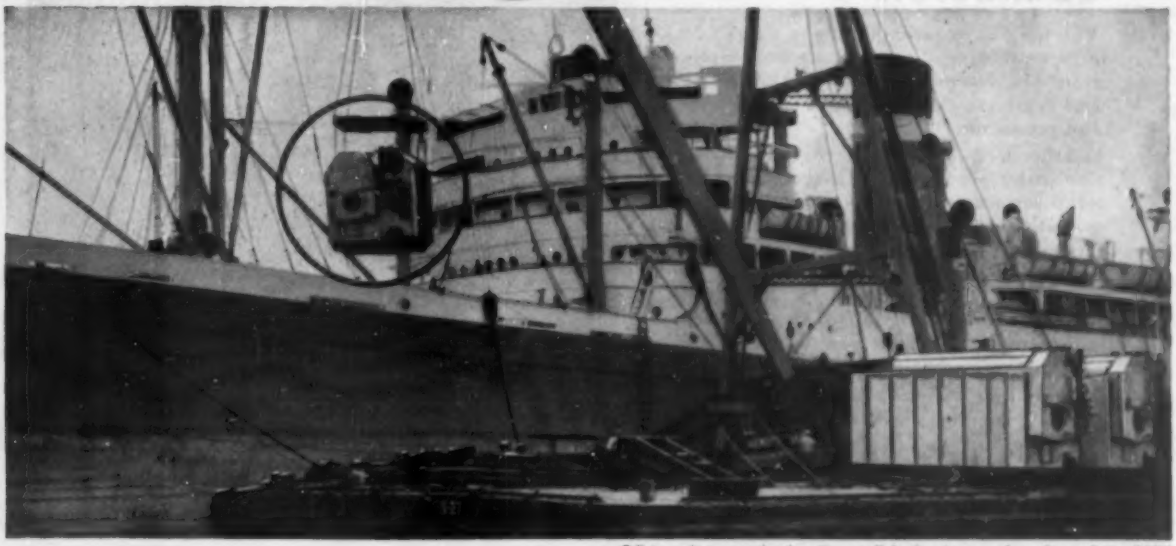
Circle "key" numbers on Reply Card between pages 36/37 & 92/93. Your requests will be handled promptly.

Arc variations do not affect welding conditions

A41 A welder designed to further the advances made with the shielded inert gas metal arc process by maintaining stable welding conditions regardless of arc variations is rectifier type 500 ampere 100 percent duty cycle welder, announced by Miller Electric Manufacturing Co. It consists essentially of closely coupled three phase transformer, saturable core type three phase reactor in the primary circuit, control windings, and a selenium rectifier stack. Remote control, using either foot or hand operated unit, is available and provides a wide choice of welder location. Panel mounted voltmeter and ammeter can be supplied. The rectangular drip-proof cabinet has removable sides and top cover that permit ready access to all parts.

keeping steam cheap . . .

BOILERS FOR Bombay



Off to a long productive "career" in foreign service, these three B&W Type FM Boilers are hoisted aboard ship at New York for the long voyage to Bombay, India. They will be followed shortly by another one.

more and more B&W Type FM Units are going into foreign service

Loading for their trip to the other side of the earth, these three B&W Integral-Furnace Boilers, Type FM, typify the growing demand for these compact, shop-assembled units by industries in many parts of the world. Ordered by the Standard-Vacuum Oil Company for their new Stanvac Bombay Refinery in India, these self-contained, B&W steam-generating units each will provide 20,000 lb of superheated steam per hr.

A water-tube unit with a fully water-cooled furnace, the B&W Type FM Boiler is designed for indoor or outdoor operation . . . is suitable for single or multiple-unit installation . . . is simple in operation, with push-button start and stop, and automatic control for meeting quick load variations. Delivered assembled, the FM Boiler is ready to be lifted or skidded into position, connected to fuel, water, and electric services, and put to work.

Combining the benefits of "packaged" steam with the advantages of big boiler design, the versatile B&W Type FM Boiler is being selected for more and more foreign installations . . . is already serving a wide variety of domestic industries, utilities, and other users. FM Units having a total steam capacity of over 7,000,000 lb per hr are now in service or on order. Available in standard sizes for loads ranging between 2900 and 28,000 lb of steam per hr at pressures from 15 to 235 psi, B&W's "midget workhorse" is also obtainable for operation at higher pressures.

OTHER COST-SAVING FEATURES

- Saves Erection Time and Cost
- Meets Wide Range of Service
- Fast Steaming
- Low Maintenance
- Easy Accessibility
- Burns Oil and/or Gas
- Saves Fuel
- Saves Space

Write for Bulletin G-76 for full details about this unique, small boiler. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

G-427

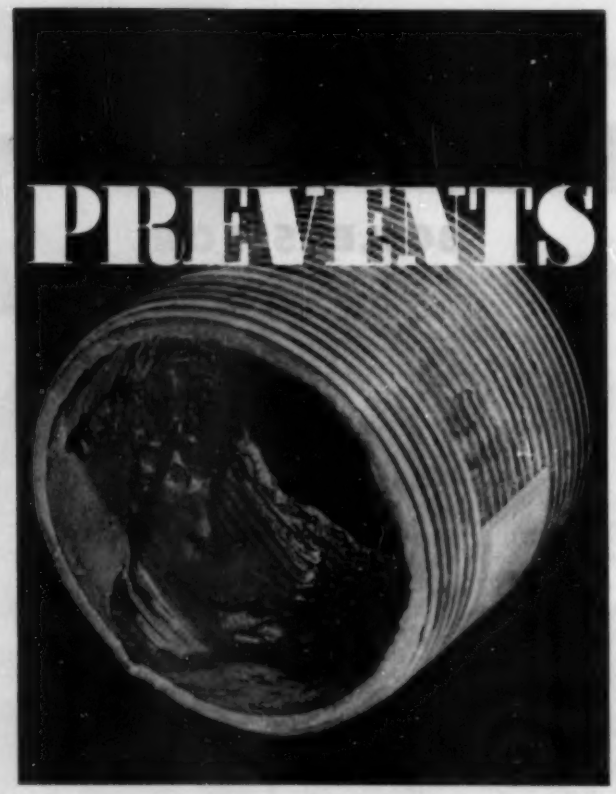
BABCOCK & WILCOX

BOILER DIVISION

Circle 518 on Reply Card for more data

Dearborn FILMEEN PREVENTS

TRADEMARK



RETURN LINE CORROSION

You may have seen this many times . . . pipe and fittings eaten through by corrosion. The line must be taken out of service and replaced, causing costly maintenance and production loss.

Dearborn Filmeen* prevents such destruction with a protective film that coats the interior surfaces to prevent corrosion. Minute quantities of Filmeen establish and maintain this protective film throughout the system. Because of its dispersible characteristics, Filmeen will penetrate to every part of the steam and condensate system. Also, Filmeen is non-toxic and, when used as recommended, can be safely applied where steam comes in direct contact with food or where steam is used for sterilization. Write for Bulletin 5013-A. **Pat. No. Re-23614*

Dearborn 659** Sludge Conditioner

The most important development in sludge conditioning is Dearborn Formula 659. This treatment conditions sludge to a fluid, non-adherent form readily removed by blowdown—protects against scale formations in water feeding systems—eliminates corrosion in feedwater systems and boilers. Formula 659, furnished in powder or briquette form, also contains Dearborn's patented Polyamide stabilizing agent which assures high purity steam. Write for Bulletin 5008-B. ***Pat. No. Re-23085*

Untreated sludge **settles into a compact mass causing sludge and scale deposits. Note how sludge adheres to glass.**

Treated sludge **produces fluid, non-adherent particles which readily disperse to prevent packing and attachment.**

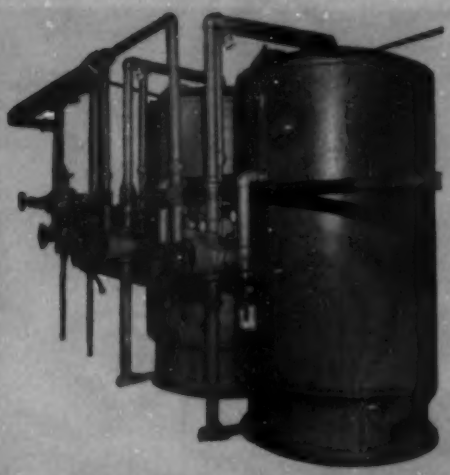
Dearborn

TRADE MARK

COMBATTING CORROSION EVERYWHERE SINCE 1887

DEARBORN CHEMICAL COMPANY · Merchandise Mart Plaza, Chicago 54, Illinois

Dearborn OFFERS A COMPLETE WATER CONDITIONING AND ENGINEERING SERVICE



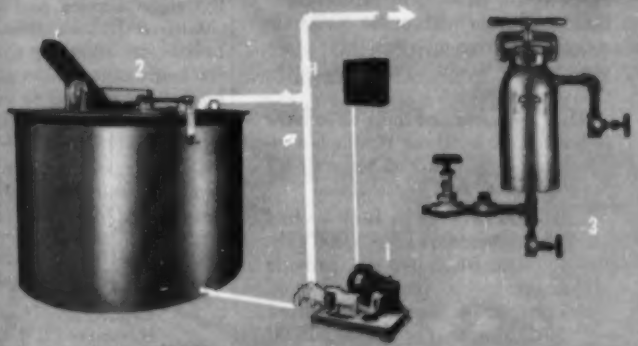
Whether you require a manual, semi-automatic or completely automatic system, Dearborn gives you a customized program including (1) the initial plant survey; (2) external and internal treatment recommendations; (3) properly designed feeding equipment; and (4) supervisory service. Here, from a single source, you have all the facilities for maximum efficiency and economical performance in your water conditioning operations.

ZEOLITE SOFTENERS

A Dearborn installed 500,000-gallon Zeolite water softener for the treatment of boiler water makeup.

DE-IONIZING PLANTS

This Dearborn 2-bed De-Ionizing unit is capable of producing 75,000 gallons of demineralized water per day. Piped throughout with Saran-lined steel. Includes corrosion-resistant ejectors, rubber-lined tanks and valves. On special applications where mineral-free water is required, a Dearborn De-Ionizing plant will reduce the mineral content of water to the equivalent of that produced by evaporation . . . and at a much lower cost. Write for Bulletin 5005.



INTERNAL TREATMENT

(1) High-pressure pump, (2) hand-agitated chemical tank for delivering treatment directly into the boiler drum, (3) Type H feeder for manual application of either briquette or powdered treatments. Write for Bulletin 5000.

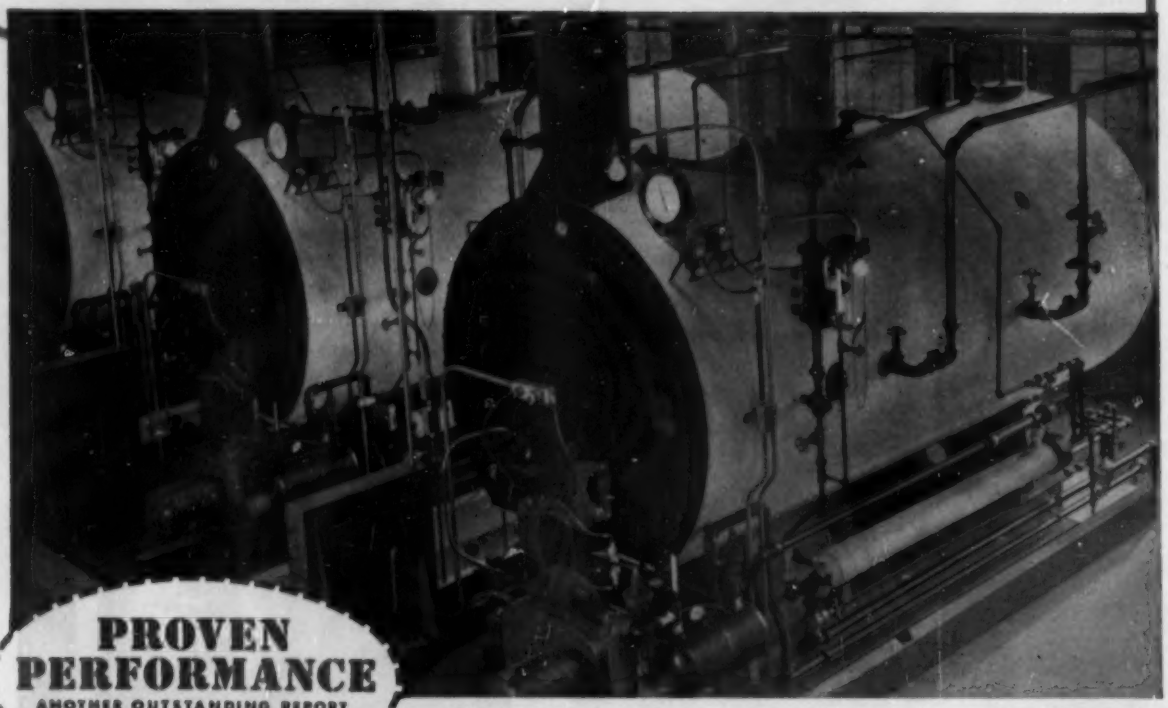
why you can rely on Dearborn

Dearborn has specialized in the conditioning of water and the control of corrosion since 1887. This broad experience in water treatment and rust prevention—plus Dearborn's extensive laboratory and research facilities—are at your service . . . at no obligation. You'll find it will pay you to . . .

know your *Dearborn* engineer

Circle 519 on Reply Card for more data

Cleaver-Brooks boilers save $25,000 per year for Hoosac Mills...pay for themselves in 2 years' time!



PROVEN PERFORMANCE
ANOTHER OUTSTANDING REPORT FROM A CLEAVER-BROOKS OWNER

After installation and starting service was completed, a check was made on boiler output. Tests indicated efficiency exceeded the guaranteed 80%. After eight months' operation without tube cleaning, stack temperature showed no noticeable gain, indicating high efficiency had been maintained. *Planned and installed by Frank I. Rounds Co., Newton Highland, Mass.*

INSTALLING 3 Cleaver-Brooks self-contained boilers at Hoosac Textile Mills, New Bedford Division, was a major step in ending boiler worries. Hoosac can count on yearly savings of $25,000, and they're set up for future expansion as well.

Before deciding what type of boilers to install for replacing old, hand-fired boilers, Hoosac carefully considered these factors:

1. **Efficiency of steam generation** — the cost for supplying 12,000 lbs. of steam required each hour at peak capacity for heating and processing.
2. **Saving labor costs** — through safe, automatic operation.
3. **Cleanliness** — important to textile manufacture.

A study of past performance and prominence of similar units in the industry — showed that Cleaver-Brooks self-contained boilers would fill the bill.

Guaranteed 80% thermal efficiency was one of many influencing factors in selecting the 3 Cleaver-Brooks 150 hp. boilers. Even with loads as low as 30% of rating, these boilers operate with a flat 80% efficiency. (Hoosac operates their plant over widely fluctuating loads, particularly in summer.)

That they attained their objectives is borne out by these results — *results which showed the boilers paid for themselves in 2 years' time.*

1. **$15,000 savings in fuel** — fuel cost studies showed 275,000 gals. of oil at 5½¢ per gal. provide steam for a year's operation. Same steam formerly required 2,000 long tons of coal at $15.00 per ton.
2. **$10,000 savings in labor costs** — fully automatic operation minimized boiler maintenance. Personnel were then available for productive plant work.
3. **Cleanliness** — modern boiler room proved more efficient than previous cluttered arrangement. Hand firing, removal and disposal of fly-ash was eliminated.

At present, boiler operation is rotated so all three periodically receive the same service and maintenance.

Cleaver-Brooks steam or hot water boilers are showing similar savings for many other businesses. Standard boilers for heating or processing are available in a complete range of sizes from 15 to 500 hp, 15 to 250 psi—oil, gas or combination oil/gas fired. Investigate now—write for Catalog AD-100 and complete information.

CLEAVER-BROOKS COMPANY
Dept. A, 302 E. Keefe Ave.,
Milwaukee 12, Wis., U.S.A.

Cleaver-Brooks
ORIGINATORS OF THE SELF-CONTAINED BOILER
Steam Boilers • Oil and Bitumin Tank Car Heaters • Distillation Equipment
Oil and Gas Fired Conversion Burners

Circle 520 on Reply Card for more data

letters

. . . from readers

Karassik Qualified

Sir:

It is perhaps presumptious of me to take issue with an authority on centrifugal pumps such as Mr. Karassik, but having been in charge of the maintenance of a considerable number of centrifugal pumps for quite a few years I think Mr. Karassik should have qualified his statements in your December 1953, (Centrifugal Pumps . . . Pump Materials, page 82), issue a little.

First, stainless steel is one of the most miserable materials ever used for shaft sleeves. If used on the graphite lubricated packings it will score on the slightest provocation. None of the manufacturers ever thinks to caution the users about these points.

Second, pump shafts without sleeves are a bad business as sooner or later some careless attendant, and there are few that aren't these union controlled days, will overtighten the packing or do some other foolish thing and you have a scored shaft. If you try to build it up with sprayed metal you get stress concentration point where it was turned down to take the spray, and it is only a question of time until it breaks—so you may as well replace it at once. Result—a much more expensive and troublesome repair job as compared with replacing shaft sleeves.

Hard shaft sleeves—nitrited when obtainable—and preformed packings are a big help and probably the cheapest in the long run.

H. D. Fisher
New Haven, Conn.

For Engineers' Files

Gentlemen:

Many thanks for the tear sheets of "Water in Air Conditioning Systems" from the November issue of INDUSTRY AND POWER.

. . . . providing us with these for our engineers' files is greatly appreciated.

Harold Brunner
Allis-Chalmers Manufacturing Co.
Milwaukee, Wisconsin

Reference Material

Sir:

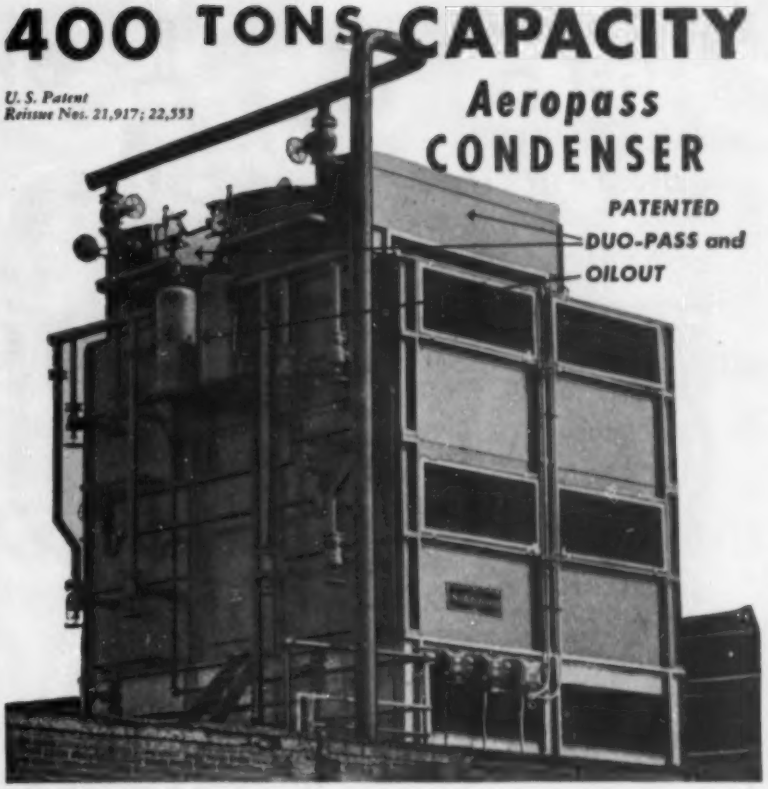
I would certainly appreciate getting a copy of this article ("Inter-

400 TONS CAPACITY

U. S. Patent Reissue Nos. 21,917; 22,553

***Aeropass* CONDENSER**

PATENTED DUO-PASS and OILOUT



YOU USE LESS POWER...
SAVE CONDENSER WATER...
SAVE UPKEEP COST

For large refrigeration systems, NIAGARA gives you a choice between a battery of condensers (that may be cut on or off with the load) or a high capacity condenser that saves space.

Both have the patented "Duo-Pass" and "Oilout" that remove superheat and keep the system free of oil. Results: you save one-third or more of power cost and upkeep expense. Niagara Patented Balanced Wet Bulb Control gives lowest head pressure operation automatically. *Write for Bulletin 111.*

NIAGARA BLOWER COMPANY

Over 35 Years' Service in Industrial Air Engineering

Dept. IP, 405 Lexington Ave. **New York 17, N. Y.**

Field Engineers in Principal Cities of U. S. and Canada

Circle 521 on Reply Card for more data

The MODERN Steam Trap

Moving parts, particularly in steam traps, are subject to to corrosion, pitting, sticking and breaking.

When this occurs the trap no longer functions. Time sometimes elapses before the failure is detected. The trap must then be dismantled and repaired. Production is interrupted. Costs go up.

Drainator — the modern steam trap — avoids these difficulties by eliminating the parts which cause them. It has not a single moving part but is operated by properties in the steam. A fluctuating gauge glass signals that the trap is functioning properly.

Modernize your steam using equipment by installing the modern steam trap. Write for the complete and interesting story now.

THE COE MANUFACTURING COMPANY
502 BANK STREET • PAINESVILLE, OHIO

Gentlemen:

Please send us literature describing items checked

☐ COE Drainator Steam Traps
☐ COE Safety Water Heater

Name_____

Address_____ City_____

Company_____

Circle 522 on Reply Card for more data

letters

—Starts on page 33

preting Stack Losses," August, 1953) because it's a mighty interesting subject and one that I would like to have available for references.

L. J. Westin
Union Iron Works
New York City

Fire Protection

Sir:

Your article on "Engineered Fire Protection," in the December issue of INDUSTRY AND POWER is very good. It calls attention to the requirements that have to be met as well as the details of the systems themselves. It should help engineers to examine their own problems.

Henry D. James
Consulting Engineer
Pittsburgh, Pa.

Combustion Control

Sir:

The November, 1953 issue of INDUSTRY AND POWER included a very good article entitled, "Instrumentation and Combustion Control for Small Steam Plants."

This article will be of very much assistance to me. I would appreciate receiving three or four copies if reprints are available.

F. Vander Ploeg
Meters and Controls, Inc.
Chicago, Illinois

Jamestown Power Plant

Sir:

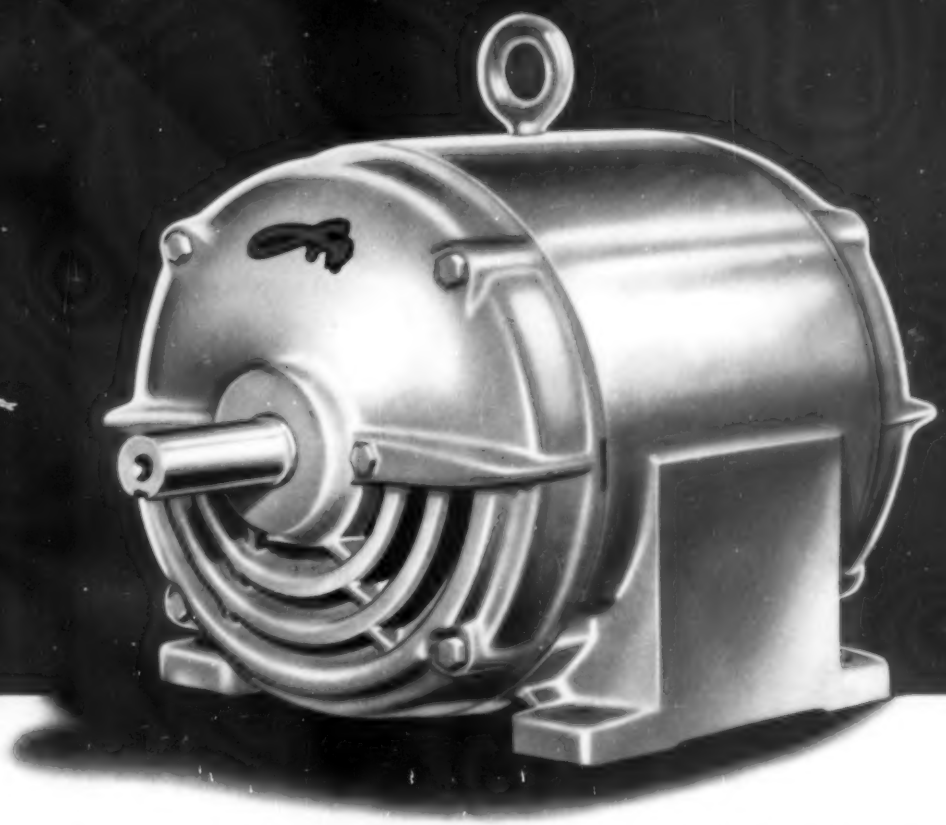
It is with real pleasure that we notice in the current (December, 1953) issue of INDUSTRY AND POWER that you have featured the Jamestown Power Plant in a splendid article prepared by Walter Rudolph, and the attractive photograph of the turbine and condenser in this plant displayed on your cover.

I know that I speak for the officers and staff of our corporation and especially for those men who worked on this project when I say that we sincerely appreciate the attractive way in which you presented this interesting project to your readers.

C. Herbert Wheeler, Jr.
The J. G. White Engineering Corp.
New York City

Not just a "face-lifting" to meet the new NEMA standards,
but a completely redesigned motor line

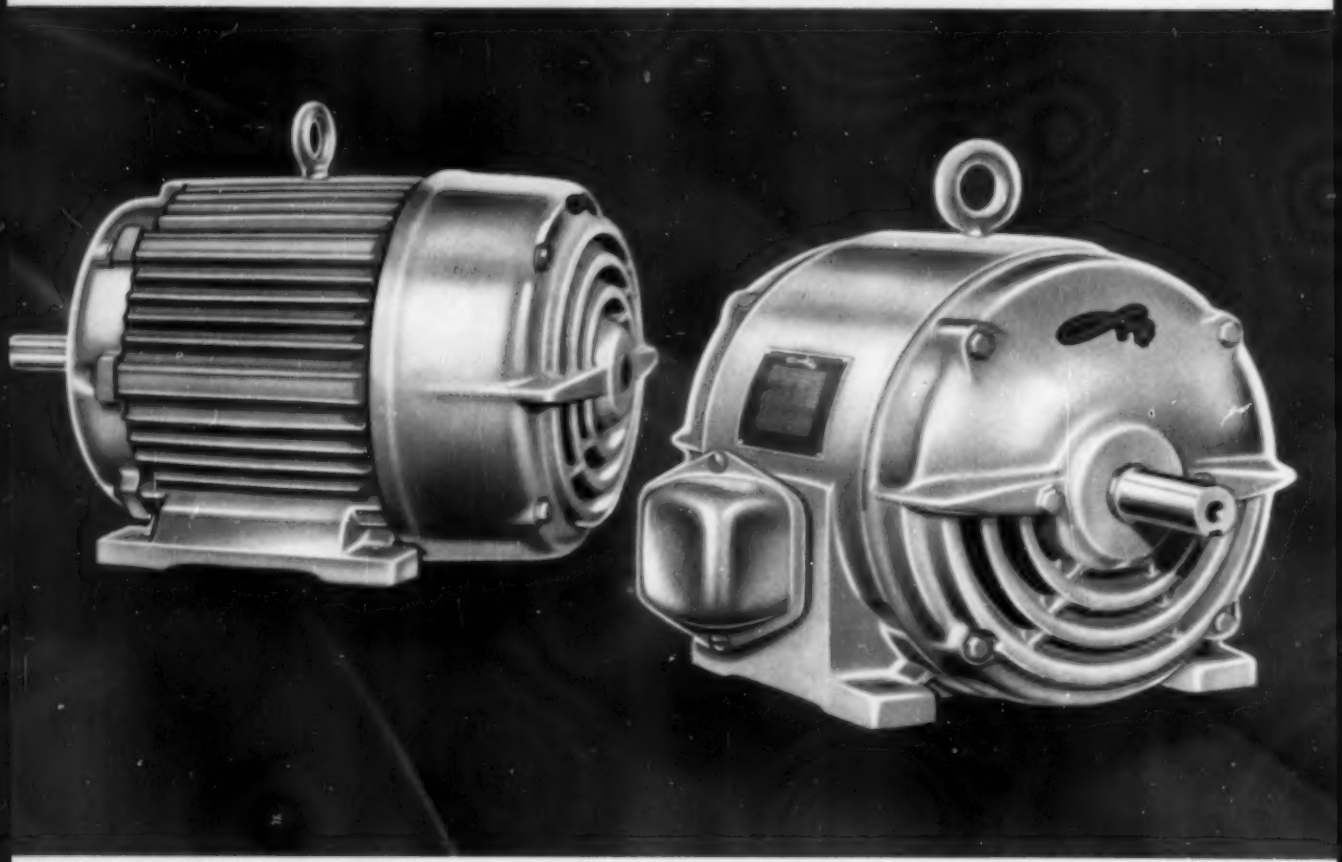
The Louis Allis Co. proudly presents the NEW L.A. *Line of electric motors*



. . the concentrated utilization of over 50 years of engineering and development brings you this new concept in motors.

Please turn the page . . .

Here's new power for all standard and special motor applications



▲ New L. A. Fan-cooled and Explosion-proof Motor

▲ New L. A. Open Drip-proof Motor

From over 50 years of motor building experience and

many famous firsts including

the first fan-cooled, explosion-proof motor
the first rapid-reversing motor
the first really splash-proof motor
the first screenless textile motor

comes the NEW *Line*

Here's the motor that's entirely new through and through, with such features as new modern styling... improved ventilation ...greater protection... new conduit box arrangement ...new bearing construction... and more versatile mounting. Get the facts on the most up-to-date motors available—the new L.A. line. See how these new motors can provide more power in a smaller package for your product or plant ...with the same high standards of Louis Allis performance, temperature ratings, service factors and torques. Call your Louis Allis Sales Engineer for the complete story.

Special Note *Louis Allis motors, built to the same high standards of quality and performance in the old NEMA standard frame sizes, will still be available if you require them for interchangeability or replacement.*

THE LOUIS ALLIS CO. · MILWAUKEE 7, WISCONSIN

Printed in USA

new bulletins

. . . catalogs from leading manufacturers

200—Boiler Replacement

"What Every Business Man Should Know About Boilers," has been prepared to give executives a better understanding of boilers and a realization of the tremendous loss that industry is taking due to obsolete and inefficient steam generating equipment. Chances are two to one that your boiler is obsolete, according to this 14-page booklet. The term "packaged steam generator" is explained along with the advantages of using such units. Superior Combustion Industries, Inc.

201—Blowers

Bulletin 1137 gives complete information on the Model G9B blower which employs a fixed position rotating element to clean a large number of tubes by sweeping through a pre-determined arc. The bulletin suggests the various uses for boilers, superheaters, reheaters, economizers, heat exchangers, and oil stills. The blower described is available for three pressure ranges up to and including 1500 psi. Diamond Power Specialty Corp.

202—Shop Assembled Boilers

Two-drum, bent tube package boilers for steam and high pressure, high temperature hot water are discussed in a four-page folder. Ratings, data, and dimensions are given along with cross-sectional drawings. Springfield Boiler Co., Div. of John W. Hobbs Corp.

203—Precipitation Equipment

Engineers contemplating the installation of equipment for recovering dusts, fly ash, fumes, mists, fogs, or other similar suspensions in stack or process gases will find much valuable data in this 40 page booklet. It summarizes the latest advancements in this company's precipitator equipment, outlines various types of electrode designs, shell constructions, electronic and mechanical rectifier systems, and also gives helpful information on combination mechanical-electrical recovery systems (CMP Units). Western Precipitation Corporation.

204—Dust and Fume Removal

This 19-page bulletin, 610, pictures and describes the standard units that go to make up the Multi-Wash System for the removal of air-borne dust, fumes, vapors, and odors. Besides explaining the operation and advantages of each component of the system, the booklet includes many installation photographs. Bulletins are offered covering each type of equipment made by this company. Claude B. Schneible Co.

205—Load Center Substations

"Power at Load Centers Pays Off," 24-page booklet 11B6285B, explains what a load center unit substation is, how they can help improve low voltage caused by heavily loaded feeders, and how they can be placed indoors or outdoors at any convenient location near the load. The selection of proper protective equipment for a specific system is also covered along with information on four types of available transformers—oil filled, sealed dry type, open dry type, and Chlorextol liquid filled. Allis-Chalmers Manufacturing Co.

Clad Metals

"An Introduction to Clad Metals," by Walter L. Keene, this company's director of research, offers a comprehensive survey of the manufacture and applications of stainless-, copper-, brass- and other clad steels. The booklet is well illustrated and shows the basic equipment and processes used in the varied cladding methods attempted in the past, as well as those now in production use. **Please send requests directly to Superior Steel Corp., Carnegie, Pa., on your company letterhead.**

Metal-Working

"Metal at Work," 87 pages, is said to be one of the most ambitious projects undertaken by a multiplant corporation. In full color, it is a comprehensive study of the products and production methods of the seven divisions of this company. It is a basic primer in metal-working processes for steel boats, wire screen, alloys, tool steels, process equipment, pipelines, snowplows, and wire and cable. **Please send requests directly to Continental Copper & Steel Industries, Inc., 345 Madison Ave., N. Y. 17 on your company letterhead.**

206—Lubrication

Bearing failure, in the majority of cases, is due to inadequate lubrication rather than inability to carry the load, according to eight-page full color booklet 1848. For demonstrating the action of re-lubrication in this company's Lubriflush bearings, a series of color photos of a transparent bearing housing is reproduced. Proof that any motor bearing breathes air and therefore tends to contaminate the bearing is demonstrated photographically, to indicate the necessity of lubrication every year or so. Excerpts of statements by bearing manufacturers about the necessity of motor lubrication are presented. U. S. Electrical Motors, Inc.

207—NEMA Standards

New and old NEMA dimensions for polyphase squirrel-cage, polyphase wound-rotor, and single-phase, foot-mounted motors are shown on an 18 x 24 in. wall chart as well as separate dimensions for flange-mounted motors. Dimensions for drip-proof and totally-enclosed, fan-cooled motors are also given. Westinghouse Electric Corp.

208—Flexible Conduit

Extra flexible Sealtite conduit for electrical wiring of machine tools and industrial equipment is pictured and described in four page pamphlet EF-531. It points out the fact that this liquid-tight, extra flexible conduit is approved for these uses by the Joint Industry Council. The American Brass Co.

209—Axial Fans

This 35-page catalog, B-1013, is designed to acquaint the user with axial fans. Technical data furnished permits the proper selection of types and sizes. Physical dimensions are shown to assist in preparation of preliminary layouts. American Blower Corp.

210—Batteries

Features, specifications, and construction details are included in a 12-page booklet for 20 types of storage batteries for use in heavy duty applications. The Electric Storage Battery Co.

211—Plant Modernization

"Basic Planning—Plant Modernization and Expansion," 16 pages, outlines a detailed step by step procedure for analyzing existing plant facilities to establish the type, quality, and value of products which should be manufactured; type, number, and cost of tools, equipment and machinery required; and size, location, and cost of floor space needed for projected modernized or expanded plant and production facilities. Walter Kidde Constructors, Inc.

212—Limitamp Control

Limitamp high-voltage motor control, its operation and application are described in 16-page picture-story booklet GEA-5409. Photographs, charts, and diagrams are used to explain the coordinated control system, its economic and safety features, as well as accessory and component equipments. Typical dimensions of the full-voltage and reduced-voltage control panels are included. General Electric Co.

213—Synchronous Motors

Synchronous motors, their operation, and control are described in 16-page bulletin GEA-5873. Problems common to synchronous motor applications and their

NOTE—Each new bulletin item has a key number for your convenience in asking for a free, personal copy. Circle key numbers on Reply Card between pages 36/37 & 92/93.

LOW COST PROTECTION for EXPENSIVE EQUIPMENT

WA Standard with STEAM USERS SINCE '94

A nominal investment in well engineered accessories will protect your major capital investment in power equipment. Wright Austin has served industry conscientiously for 60 years —offers you the confidence and peace of mind that comes from knowing you are using proven designs.

Catalog 500 covers the line of separators, purifiers, exhaust heads for steam, air and gas.

SEPARATORS

Installation of the compact 31-N and other W-A separators and purifiers will guarantee freedom from damaging entrainment, oil, rust, scale and condensate in your power lines.

STEAM TRAPS

Operation of W-A traps is simple, fool-proof. Installation has been made easy and service can be performed with minimum effort and time.

Catalog 600 describes the wide range of W-A traps for steam, air and gas.

BOILER TRIM

Provisions for greater safety to equipment and worker plus peak efficiency is available at low cost in this line of 16 accessories.

Catalog 700 describes the complete line of alarms, gauges, controls, etc.

WA WRIGHT-AUSTIN COMPANY WA

3245 WIGHT STREET • DETROIT 7, MICH.

Circle 524 on Reply Card for more data

new bulletins

—Starts on page 37

solution by using the correct control equipment are explained in a question-answer technique. General Electric Co.

Steam Valves

This pressure loss calculator for steam valves is a handy, pocket size cardboard chart which does your figuring for you. Complete instructions are printed on the calculator. **Please send requests directly to Golden-Anderson, 1322 Ridge Ave., Pittsburgh 33, Pa., on company letterhead.**

214—Propeller Fans

Three new models are among the 13 types of fans shown in 40-page bulletin A-109. It also describes three types of roof ventilators, unit heaters and intake air units, and includes specifications, dimensions, and performance figures on all of the equipment plus valuable engineering data. A special feature is a discussion of corrosion-resistant materials and coatings which includes a table showing the suitability of special materials and coatings for use in a wide variety of fumes commonly encountered in industrial installations. Hartzell Propeller Fan Co.

215—Process Equipment

"J-M Products for the Process Industries," 8 pages, is arranged as a ready reference for men responsible for the design, installation, and operation of process equipment. It gives concise data on the properties of the various products and includes photographs showing typical installations. Johns-Manville.

216—Communication System

The sound system presented in 15-page booklet P831 has been designed to satisfy a critical need in power plants—the need for instantaneous, fully intelligible, plant-wide communication. Components of the system, various possible uses, and installation photographs are included. Radio Corporation of America.

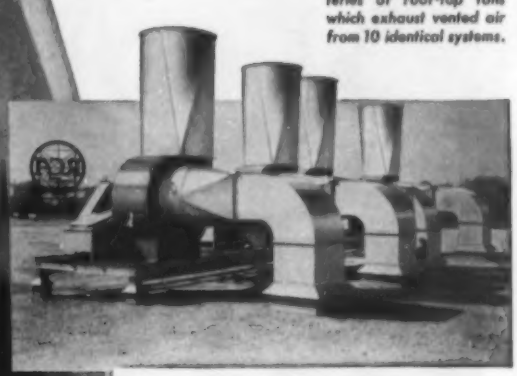
217—Power Transmission

Power transmission products to meet the requirements of today's machinery and production are described in an eight-page catalog. Advantages of special construction features are pointed out by means of cross-sectional drawing and text. Specifications are listed in tables for easy reference. Lovejoy Flexible Coupling Co.

Diesel Maintenance

"Symposium on Diesel Locomotive Engine Maintenance," 145-page manual summarizes the complete test of a two-day symposium on diesel locomotive engine maintenance held by this company last spring, and includes 31 individual papers

how to PICK UP 2,900,000 BTU without "wiggling" the flame



One of a number of batteries of roof-top fans which exhaust vented air from 10 identical systems.

. . . solved by a KIRK AND BLUM ventilation system!

Above—Battery of RCA Sealex machines. Heat from glass sealing and evacuating operations on electron tubes is collected by aluminum hoods and duct-work.

At right—Radio Tube Stem & Bulb Tubulator machines. Heat from glass working operations is picked up and vented. Replacement air is furnished by Kirk & Blum systems.

Heat can be a headache in any plant. Here, in a midwestern tube plant of RCA Victor Division, Radio Corporation of America, glass sealing and forming operations require plenty of heat of all kinds—induced, radiated and reflected. For the comfort and safety of workers, this heat must be removed but without disturbing the play of gas flames on delicate parts.

KIRK & BLUM engineers achieved a fine balance, removing 2,900,000 BTU hourly and without distorting the delicate flames.

Whatever your ventilation problem... heat, dust or fumes... the best, lowest-cost solution involves more than a fan, motor and some lengths of duct. Put it up to experts... **The Kirk & Blum Mfg. Co., 3174 Forrer Ave., Cincinnati 9, Ohio.**

KIRK AND BLUM
VENTILATION SYSTEMS

Circle 525 on Reply Card for more data

TUBELESS MAGNETIC AMPLIFIER DC SUPPLIES

for Automotive and Aircraft Industries

Sorensen Nobatrons Model MA6/15 and Model MA2850 are tubeless — using magnetic amplifier principles. They have plenty of current capacity — 100 amps at 6 volts or 75 amps at 12 volts in the MA6/15 and 50 amps at 28 volts in the MA2850. Please see the specs below.

The MA6/15 is designed primarily as an automotive production test instrument for use in checking window motors, heaters, clocks, radios, headlight dimmers, ignition systems, air conditioners, cigarette lighters. The MA2850 can be used for testing aircraft heaters, pitch changers, inverters, radar, fire control systems, etc. Built around tubeless circuits, both models are carefully engineered and built to give you years of trouble-free, dependable service. Write for information now!

SPECIFICATIONS

Model MA2850

Input voltage range	190-230, 3Ø, 4 wire, 60~ .
Output	28 volts DC, adjustable between 23 and 36 volts.
Current	0 - 50 amperes
Ripple	3% max RMS
Regulation accuracy	±1% against line and load combined
Time constant	0.5 seconds under worst conditions
Dimensions	15½" wide x 25⅛" high x 13" deep

Meters are standard.
Units are self contained.

Model MA6/15

Input voltage range	210-250 VAC, 1Ø, 60~ .
Output	Adjustable 6 - 7.7 volts DC from 0-100 amperes Adjustable 12 - 15.4 volts DC from 0-75 amperes
Ripple	1% max RMS
Regulation accuracy	±1% against line and load combined
Time constant	0.2 seconds under worst conditions
Dimensions	21" wide x 36" high x 15" deep

Meters are standard. Cabinets optional.

SORENSEN

SORENSEN AND COMPANY • 375 Fairfield Ave., Stamford, Conn.

Circle 526 on Reply Card for more data

new bulletins

—*Starts on page 37*

and articles representing the views of 21 participating railroads. It covers such subjects as spectrographic analysis of lubricating oils, filtering and filtering media, cooling water treatment, and railroad applications of the electron microscope. The book has a five-page index in which the entire subject is carefully cross-indexed. **Please send request directly to American Locomotive Co., Public Relations Department, Building 143, Schenectady, N. Y., on your company letterhead.**

218—Industrial Cranes

Twenty-four-page brochure C6-3 is illustrated with photographs of a wide variety of interesting installations of this company's industrial cranes. Explanatory diagrams and scenes showing different phases of crane production are also included. Complete specifications are listed. Harnischfeger Corporation.

219—Welding

Welding valves into lines for high pressure, high temperature service is becoming more and more prevalent, and with it has come a need for dimensional standardization. To meet this need, this company is offering four-page bulletin 507 listing socket welding and butt welding end dimensions as approved by the American Welding Society. Included are four diagrams indicating the standard preparation of valve butt welding ends. Edward Valves, Inc.

TO REQUEST FREE BULLETINS

Circle "key" numbers on Reply Card between pages 36/37 & 92/93. Your requests will be handled promptly.

220—Turbo Pump

Each component of the type DE turbo pump is pictured and its design advantages explained in a six-page folder. The lubrication system is also described in detail. Typical uses are listed. The J. S. Coffin, Jr., Co.

221—Sewage and Sump Pumps

Comprehensive, eight-page bulletin 325-A32 is for engineers, architects, and contractors who specify sewage and sump pumps. It describes in detail three types of pumps: The NKS Vertical Wet Pit Single or Duplex; the NKV Vertical Dry Pit; and the NKH Horizontal. Complete specifications are given for all types and optional equipment is illustrated and explained. Performance tables are supplied according to pump capacity and detailed help is given for selecting the correct pump. American-Marsh Pumps, Inc.

222—Hydraulic Pullers

Hydraulically operated pullers in capacities from 17½ to 50 ton with attachments and accessories for pulling and installing gears, bearings, pulleys, sheaves, shafts, and couplings are described and illustrated in 24-page manual HY-1953. Assemblies for use with the various models are pictured and explained. Owatonna Tool Co.

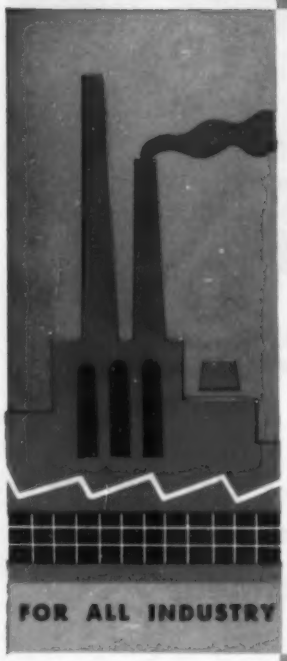
(Continued on page 96)

FOR 100 YEARS . . .

A NAME TO RELY ON

WICKES

RECOGNIZED QUALITY SINCE 1854



FOR ALL INDUSTRY

For almost a century, WICKES Steam Generators have been supplying dependable, low-cost steam to industries and institutions. Today, in every State in the Union and in foreign countries, refineries and natural gasoline plants, steel mills, foundries, ships, chemical processing plants, atomic energy installations, public utilities and many other industries depend on WICKES for efficient steam production. In schools, hospitals, public buildings and institutions, WICKES Boilers supply steam for heat and power.

WICKES can fill your requirements for all types of multiple drum boilers with capacities up to 250,000 lbs. steam per hour at pressures up to 1000 psi., adaptable to any standard method of firing. In pressures up to 900 psi. with sustained steam production up to 40,000 lbs., WICKES Boilers can be shop assembled ready for immediate installation. For complete information, consult your nearest WICKES representative or write us today!

FOR PUBLIC BUILDINGS AND INSTITUTIONS

FOR SHIPS

WICKES

THE WICKES BOILER CO., SAGINAW, MICHIGAN
DIVISION OF THE WICKES CORPORATION • RECOGNIZED QUALITY SINCE 1854

SALES OFFICES: Albuquerque, N. M. • Boston • Buffalo • Charlotte, N. C. • Chicago • Cleveland • Dallas • Denver Detroit • Fort Wayne, Ind. • Houston • Indianapolis • Los Angeles • Memphis • Milwaukee • New York City Portland, Ore. • Saginaw • Salt Lake City • San Francisco • Springfield, Ill. • Tampa, Fla. • Tulsa • Washington, D. C.

151

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How to make packings last longer

Tips by Johns-Manville Engineers to help you keep production rolling

...and this new chart makes it easy to choose the right J-M Packings for your power plant equipment

A handy 6-page guide, "Johns-Manville Packings for the Power Plant" simplifies the selection and application of power plant packings. Covering 32 of our most popular styles, it tells at a glance what J-M packings to use... why they are recommended... and how to install them.

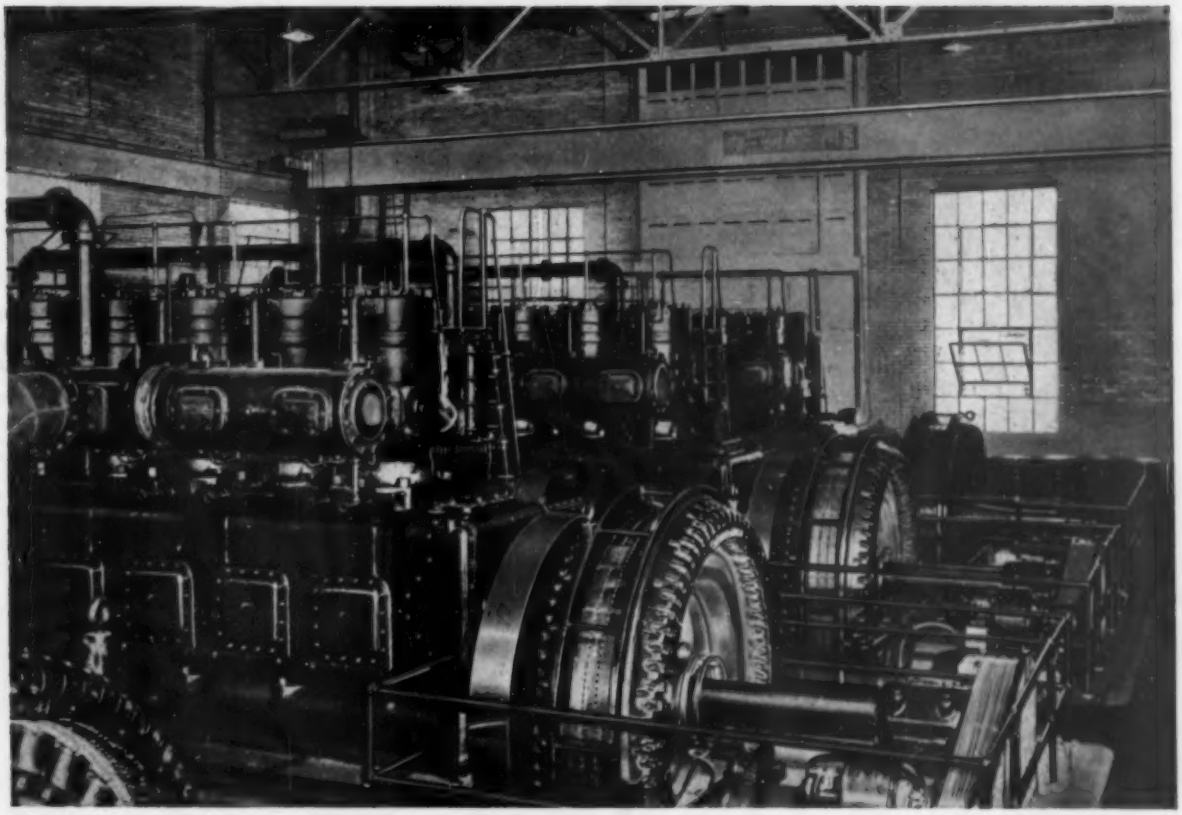
Its schematic diagram is spot-keyed to help you locate packing styles for various equipment units. Its brief group-headings help you select J-M packings for centrifugal and rotary services, reciprocating rods and plungers, valve stems, pipe flanges, manholes and handholes... to seal against steam, water, oil, brine, etc.... to withstand various temperatures and pressures. Its condensed packing descriptions give you essential buying information.

And a page is devoted to tips on proper installation to help you get maximum economy and efficiency from your Johns-Manville packings.

Your local Johns-Manville Packing Distributor will be glad to give you a copy of this handy packing selector, free of charge. Or write to Johns-Manville, Box 60, New York 16, N. Y., asking for Brochure PK-61A. In Canada, address 199 Bay Street, Toronto 1, Ontario.

Johns-Manville PACKINGS & GASKETS

Circle 528 on Reply Card for more data



"We're Proud of This Plant!"

says Don H. Decker, — Plant Supt., Thumb Electric Cooperative, Ubly, Mich.

Manager Orville Hurford and Mr. Decker are justifiably proud of their 4-diesel engine generating station. The plant has been an outstanding financial success since the day it was first opened. Several times it has occupied #1 position on the REA Running Plant capacity chart.

Mr. Decker writes, "A large part of our operating success we attribute to Sinclair GASCON® D oil. It has given us an excellent rate of consumption while reducing wear. In fact, *cylinder and piston ring wear is much below normal based on other plants of equal capacity*. Something else we appreciate is the timely visits of the Sinclair Lubrication Engineers."

Top quality lubricants plus the assistance of Sinclair Lubrication Engineers are two of the reasons why Sinclair can play a large part in the success of *your* operation. Your local Sinclair Representative will be happy to explain the remaining reasons. Phone him or write Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

SINCLAIR DIESEL LUBRICANTS

save Wear and Replacement

Circle 529 on Reply Card for more data

6 OF THE MANY McALEAR CONTROL GUARDSMEN

Pilot-operated pressure reducing valve for accurate control of reduced pressures . . . single seated closed valve affording dead end service.

Stop and check control — used with two or more boilers — automatic safeguard against reverse steam flow.

Suction and pressure type strainer —clamped or bolted cover—adaptable to any strainer service.

Self-cleaning "Y" strainer — used to protect regulators, pumps and traps by removing foreign matter from the line.

Feed water regulator—used for continuous feed to boiler to maintain water level. Has mercury cut-out switch as additional safeguard in case of low water.

Back pressure valve—Single seated vertical type . . . efficient—noiseless. Operates with condensing and non-condensing engines.

You can forget control problems if you REMEMBER McALEAR

There's a safe way to forget all about your control problems—just remember McALEAR. For when you use McALEAR controls you benefit from a background of fifty years of experience covering every type of installation. You know you have controls engineered to an exactness . . . controls that are just right for the specific job. You can depend on McALEAR because (1) There is an expert engineering service behind every product; (2) McALEAR sales representatives are hand picked for control know-how; (3) McALEAR controls are available through leading plumbing and heating wholesalers.

McALEAR
PRESSURE · FLOW · LIQUID LEVEL · TEMPERATURE
controls
for STEAM, WATER, AIR, OIL-GAS

McAlear Manufacturing Company
1901-1919 South Western Avenue
Chicago 8, Ill., U.S.A. MC-500

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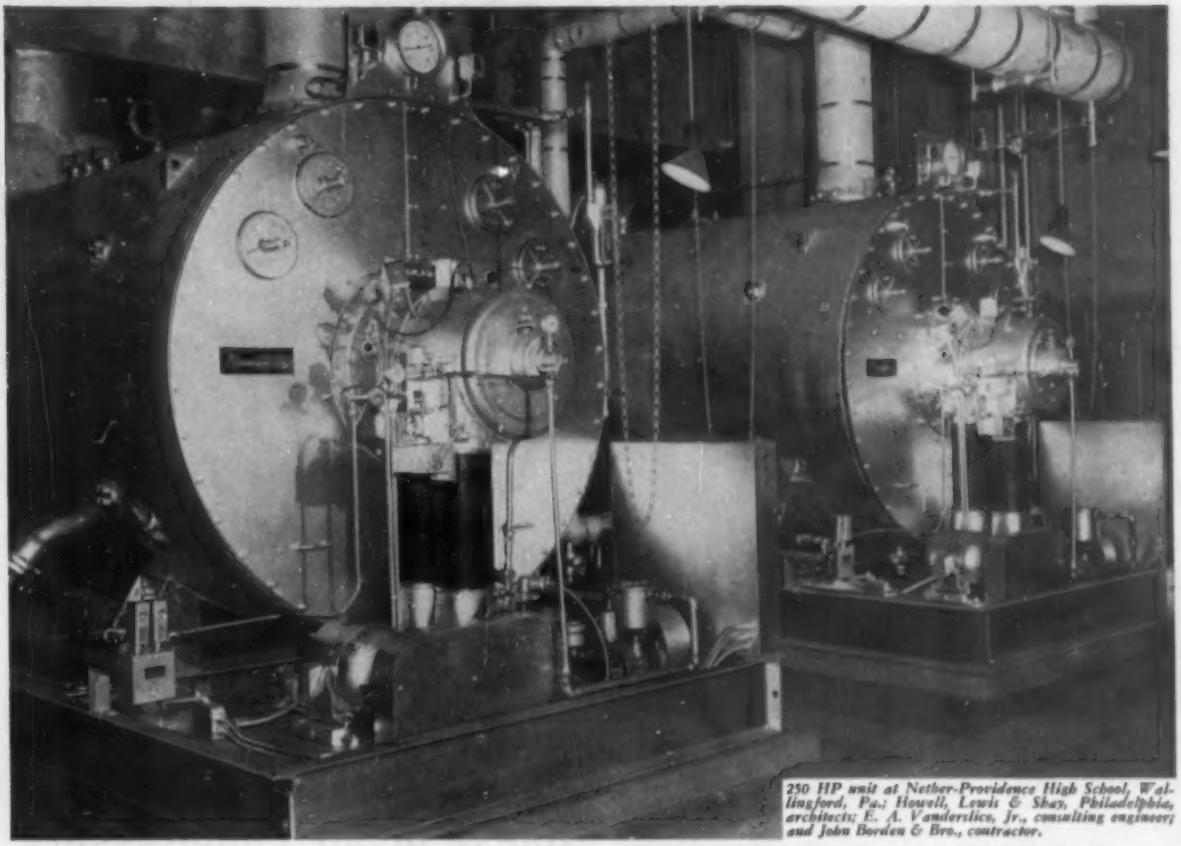
at SCHOOLS and COLLEGES



250 HP unit at Nether-Providence High School, Wallingford, Pa.; Howell, Lewis & Shay, Philadelphia, architects; E. A. Vanderslice, Jr., consulting engineer; and John Borden & Bro., contractor.

Powermaster® Excells in All Tests

ALL OVER AMERICA, steam and hot water requirements for public and parochial schools, private schools, trade schools, and colleges are being supplied by *Powermaster* Packaged Automatic Boilers . . . with an outstanding record of reliability and economy. Why have they been so widely "accepted" in educational circles by men who can evaluate the aptitude of boilers for this particular kind of service? Because by all standards of comparison, *Powermasters* possess these qualifications for "enrollment" in any kind of school: Ease and economy of installation—space-saving compactness—fuel-saving smokeless combustion—fuel-saving operation at *all* loads—maintenance-saving accessibility—completely automatic operating and safety controls—minimum attention of service personnel.

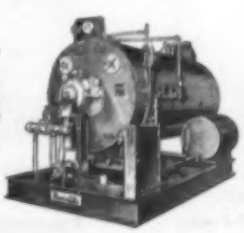
Compare *Powermaster* with any other packaged boiler and you'll understand why it is today's best buy for institutions of learning . . . or buildings . . . or hospitals . . . or industrial plants. Send for latest descriptive bulletin.

O·S

Powermaster®

PACKAGED AUTOMATIC BOILERS

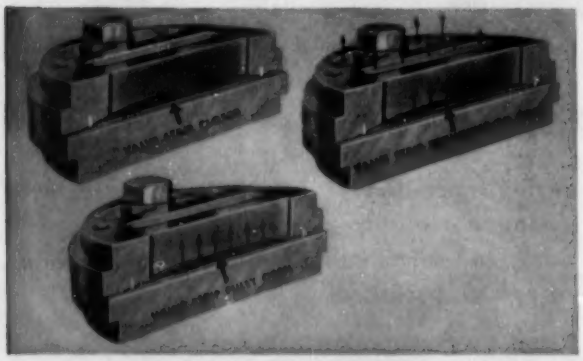
In sizes to 500 HP; pressures to 250 psi.



ORR & SEMBOWER, INC. • Established 1885 • **Morgantown Road, Reading, Penna.**

Circle 531 on Reply Card for more data

PERFECTION STOVE'S ULTRA-MODERN POWER PLANT is equipped with two Worthington DC-2 air compressors, each with a capacity of 1000 cfm.



QUIET-OPERATING WORTHINGTON FEATHER* VALVE is made up of a series of thin flexible strips of ribbon steel, held in position over rectangular openings by curved milled guards. The valve strips lift and flex uniformly against the curved guards. In addition to quiet operation, the absence of impact results in long valve life and low maintenance costs.

Perfection called for the finest in air compressors

• The Perfection Stove Company's new Ivanhoe Road power house in Cleveland has received national recognition as a leading example of modern, medium-size power plant design.

Every piece of equipment in this million-dollar plant had to meet the rigid specifications of Perfection's engineers. That's why, when it came time to supply compressed air for general plant use, two Worthington DC-2 horizontal air compressors were selected.

By installing these modern Worthington compressors, Perfection engineers made sure they would get lowest-cost compressed air and longest compressor life. The exclusive Worthington Feather* Valve—the lightest, tightest, most efficient valve made—is largely responsible for that.

Take a tip from Perfection Stove and find out for yourself about the Worthington line of air compressors. Write to Worthington Corporation, Compressor Division, Section K.3.7, Buffalo, N. Y. **Reg. U. S. Pat. Off.*

K.3.7

WORTHINGTON

Only Worthington Compressors give you Feather Valve Performance

Y-Types • Balanced Angle • Horizontal • Portable • Radial • Gas Engine Compressors

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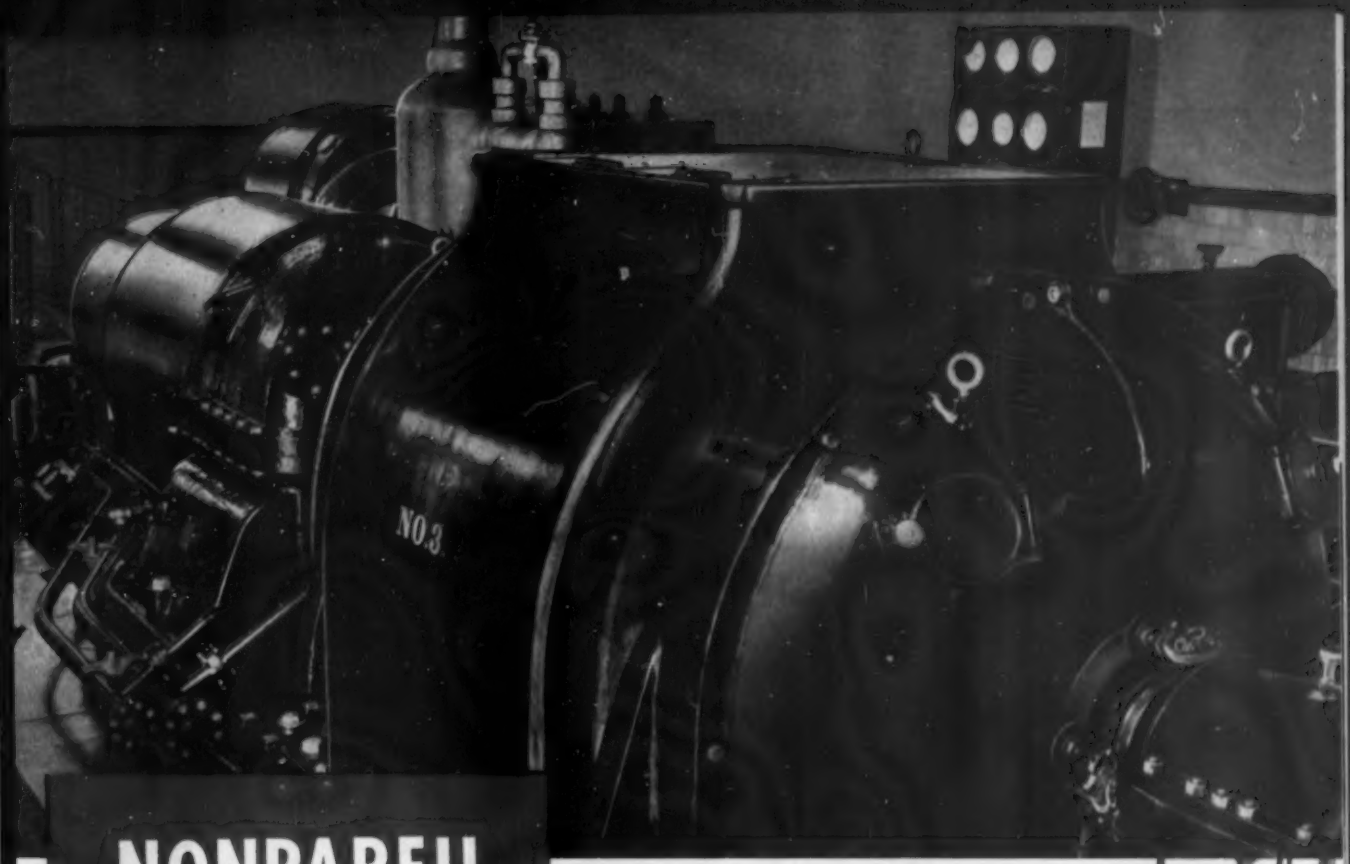
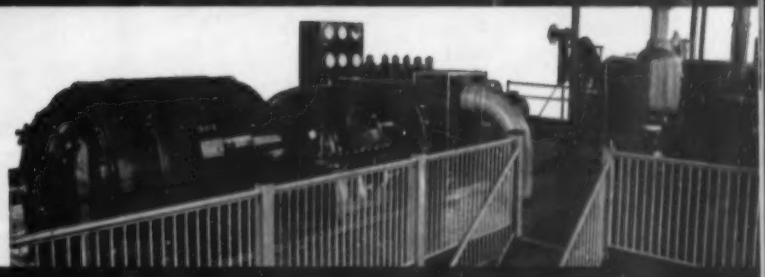


NONPAREIL
TRADE MARK
Turbine Oil



How they eliminated turbine oil replacements

● Operators of this midwest power plant recall the time when a conventional lubricant was used in the plant's three turbines (now, four). A fill of oil was good for about three years and then it had to be replaced because of increased acidity and other indications of oil deterioration.

In 1939, a Standard Oil lubrication specialist recommended NONPAREIL Turbine Oil, and the switch was made. Since that time, none of the original fills of NONPAREIL has needed to be replaced. For that matter, no fill of oil has needed to be removed from its turbine for any purpose. Lubrication systems have remained clean. Neutralization numbers of oil fills have stayed below 0.06 mg. KOH/gm.

Fourteen years of trouble-free turbine lubrication is just the beginning for this plant. Each fill of NONPAREIL is guaranteed in writing to last as long as the turbine it lubricates and to maintain a neutralization number below 0.15 mg. KOH/gm.

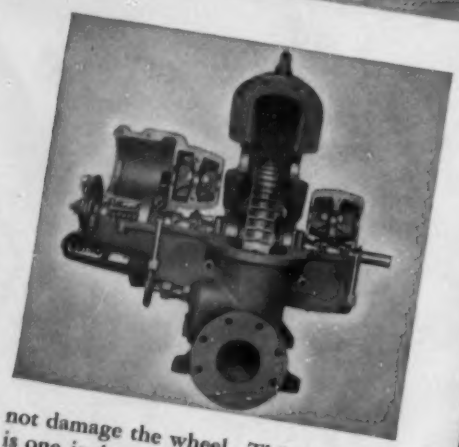
Ask the Standard Oil lubrication specialist serving your area of the Midwest to show you how NONPAREIL and its written guarantee will assure you of completely trouble-free lubrication for the life of your turbines. Phone your local Standard Oil office. Or, write: Standard Oil Company, 910 So. Michigan Ave., Chicago 80, Ill.

STANDARD OIL COMPANY STANDARD *(Indiana)*

Circle 533 on Reply Card for more data

TERRY

LARGE CLEARANCES *take the "worry" out of* Turbine Operation

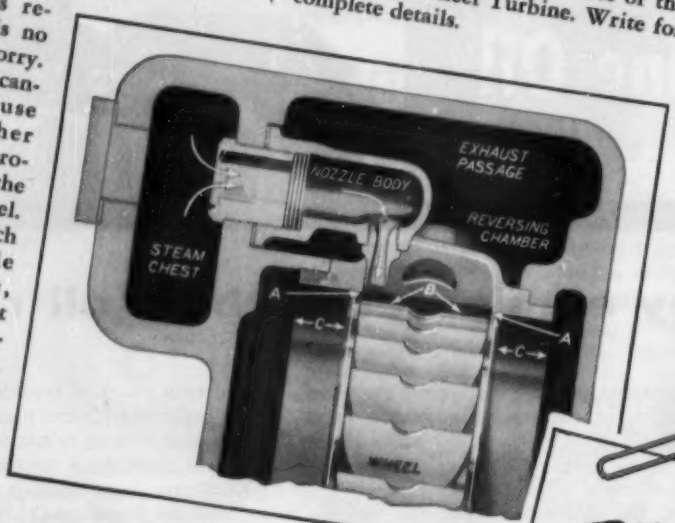


In a Terry Solid-wheel Turbine the power-producing action of the steam in the wheel takes place on the curved surfaces at the back of the buckets. This unique design permits unusually large blade clearance—see B in the diagram.

Even if this clearance becomes reduced, there is no real cause for worry. The blades still cannot foul because they are further protected by projecting rims at the sides of the wheel. These rims, which also have ample clearances (AA), will take without damage any rubbing that may occur.

Side clearance, CC, is so large that end-play from external thrust will not damage the wheel. This clearance is one inch or even greater.

Large side and blade clearances are only two of the many features of the Terry Solid-wheel Turbine. Write for complete details.



THE TERRY STEAM TURBINE CO.
TERRY SQUARE, HARTFORD 1, CONN.

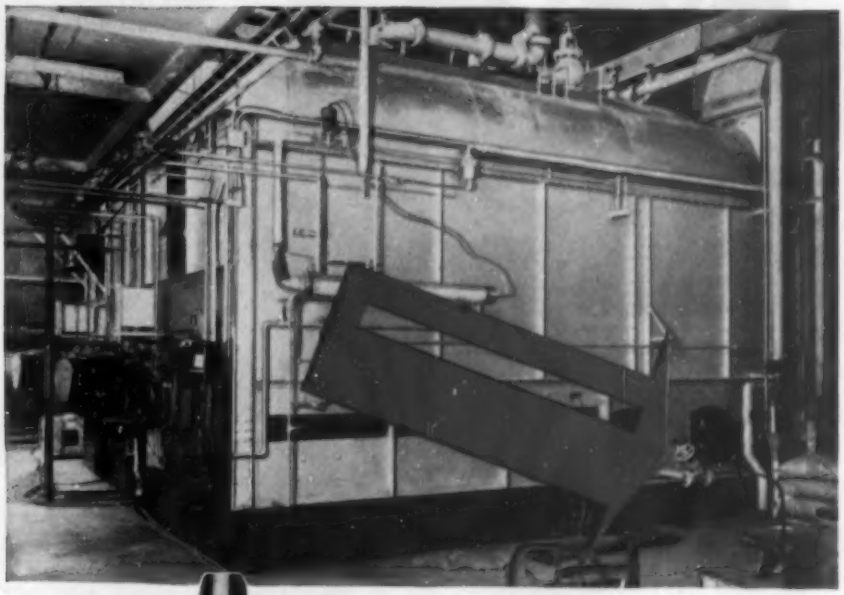
T1-1191

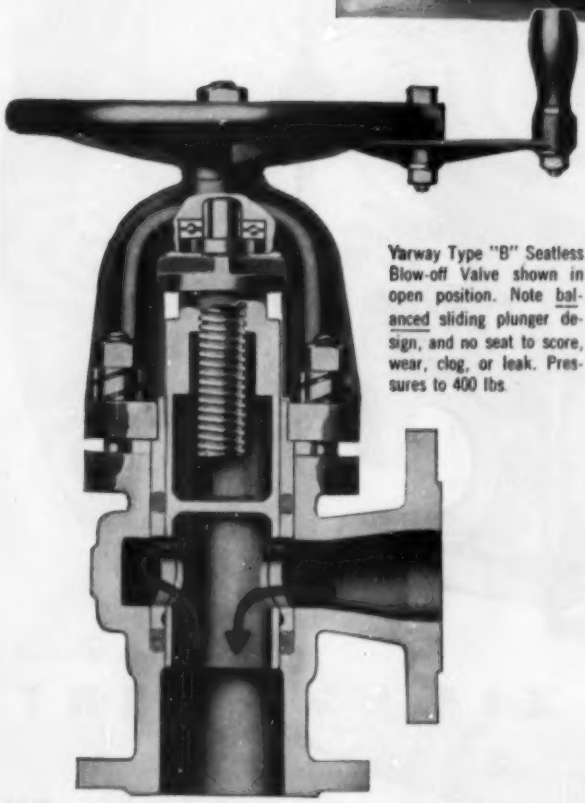
Memo

Send for a copy of bulletin S-116 which describes the many advantages of the Terry Solid-wheel Turbine.

Circle 534 on Reply Card for more data

THIS ERIE CITY "PACKAGE" INCLUDES A YARWAY SEATLESS





Yarway Type "B" Seatless Blow-off Valve shown in open position. Note balanced sliding plunger design, and no seat to score, wear, clog, or leak. Pressures to 400 lbs.

■ The above installation of two 300 hp. Erie City VL type boilers at a Detroit automotive plant shows Yarway Seatless Blow-off Valves as part of the "package" picture.

Good package-type boilers are *better* when equipped with Yarway Blow-off Valves.

Get the advantages that have made Yarway Blow-off Valves guardians of blow-down lines in more than 15,000 boiler plants. On your package boilers—whatever the make—high grade blow-off valves pay off in dependable, trouble-free service.

Write for Yarway Bulletin B-426.

YARNALL-WARING COMPANY
109 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

YARWAY®

SEATLESS BLOW-OFF VALVES

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Guaranteed TO SHUT TIGHT*

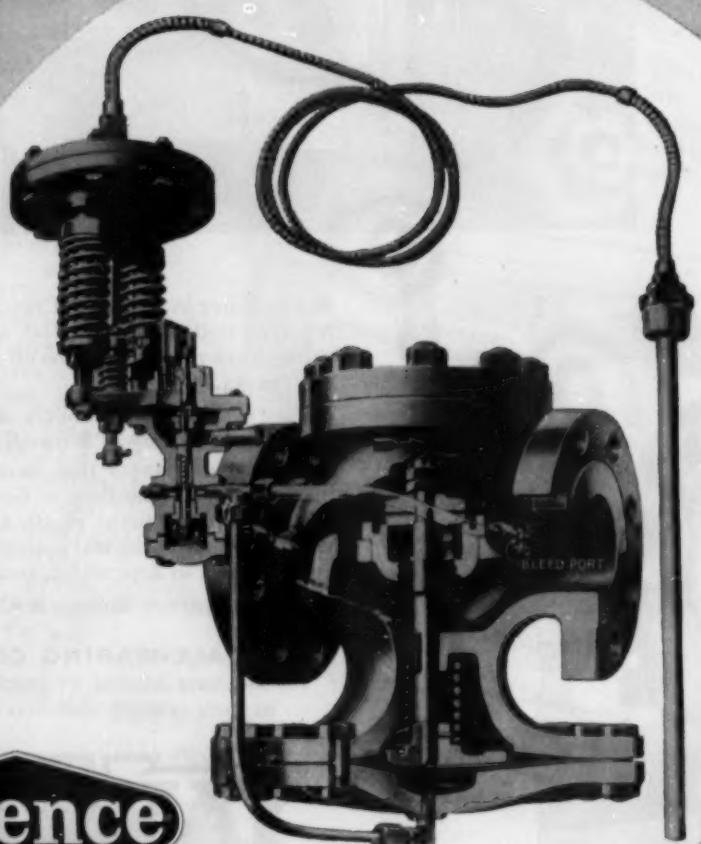
* When equipped with a SECO Metal Seat and Disc on steam service and protected by an approved Strainer, a Spence Regulator is guaranteed to shut tight when the demand for steam ceases.

Expensive steam leaks due to a lack of absolutely tight shutoff are eliminated in Spence Temperature Regulators. Here is why we can make such a guarantee:

First, our temperature regulators are of the single seat design. Seats and discs are made of durable SECO Metal. More than 20 years experience in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

These plus other design features explain why Spence Temperature Regulators function dependably and accurately year after year without requiring expensive repairs or special attention.

Want more facts? Write for Bulletin T50 giving full details.



SPENCE
TYPE ET150
Temperature
Regulator

Spence

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

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THE FINEST DAMPER THAT MONEY CAN BUY

HEACON DAMPERS *are specified* where no other dampers will work

Where tight shut-off is an absolute requirement . . . where accurate control is vital, Heacon Dampers give you the only positive answer to your problem.

Tight closure is accomplished by a radical method of sealing against the damper frame. Accurate control is provided by V-porting the lower section of the frame to provide practically any flow characteristic required.

In addition to its sealing and control characteristics, because of the unique suspension construction of the sealing curtain, operating torque is not transmitted to the supporting spindle or driving mechanism. This feature makes possible the use of a minimum and practically constant power requirement for damper operation.

Thermix, Project Engineers for Heacon will be glad to help solve your damper problems. Why not contact them today.

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these steam traps won't freeze up!

Freeze-ups of outdoor steam traps in winter weather often cause production delays. Don't take that chance . . . especially when it's so easy to install Yarways, the steam traps that *won't freeze up.*

They won't freeze because condensate does not accumulate. The only moving part—a little valve—is continually testing for condensate, discharging it as soon as it forms. There's never anything to freeze.

Other reasons why over 750,000 Yarway Impulse Steam Traps have been sold—they get equipment hotter, sooner; light weight; small size; easy to install and maintain; good for all pressures; made of stainless steel.

More than 200 industrial distributors sell Yarway Traps and Strainers. See your nearest one today. For name, and free 24-page Steam Trap Book, write . . .

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YARWAY

the steam trap designed with more production in mind

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Industrial Development Review

I&P Annual Review

THE TURN OF THE YEAR is an appropriate time for the engineer in industry to take a good look in both directions to assure himself that his plant is keeping up with or just a little ahead of the competitors. It is not only in the field of atomics and in other applications of higher applied physics that science is moving ahead rapidly. That type of development may be more spectacular than, for example, the increase in temperatures and pressures for steam boilers or the marketing of a new lubricant with wider industrial application. But it is to the important (if sometimes less soul-stirring) developments in commonly used plant equipment that the engineer must look for ways to cut costs and improve product quality. Regular improvements in methods and products of this type are taking place rapidly, and in the relatively short period of a year, a company can find some of its equipment and many of its methods outmoded.

The Editors of INDUSTRY AND POWER have been working on this special issue for several months. In fact, we have been gathering data throughout the year with the idea of presenting it to the readers at this time. We have not covered every important development. We have selected those we think are most important to our readers. Altogether we have presented a well-rounded picture of what has happened in fourteen vital phases of industry — along with a few notes (based on our best judgment) on what you may expect in the months ahead.

The Editors

Power

I&P Annual Review

Principal trend in the utility field is toward larger units operating at higher pressures and higher temperatures. In industrial steam plants, use of standardized boilers shows marked gains.

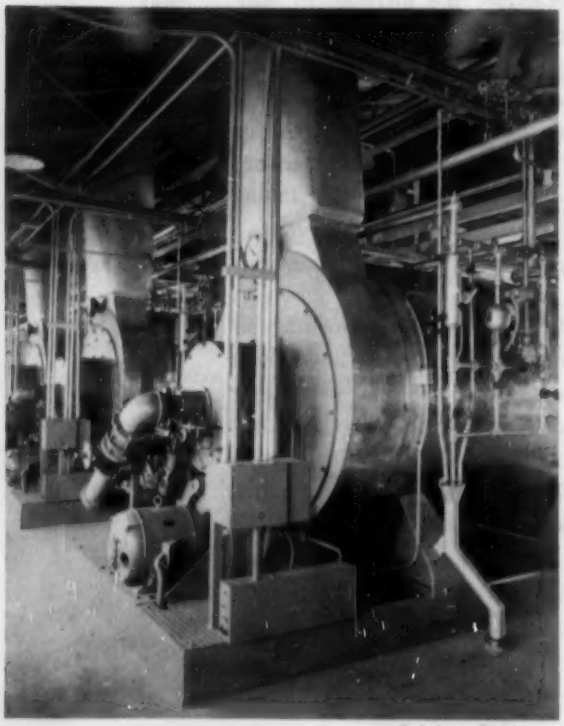
IN THE IMMEDIATE FUTURE the high growth rate of electric utility systems will continue, as it has in the past, to be the greatest single influence on the power field. Reliable reports indicate total annual generation may reach a trillion kwh by 1970; perhaps increase as much as 400 percent in the next 25 years—and many facts support this view. Annual consumption in the average home increased from 900 kwh in 1939 to 2200 kwh at present and promises to double in the next 10 years. Industrial, commercial, and rural loads are growing continuously as living standards rise with an ever-expanding national economy.

Energy requirements for this expansion will be enormous. At present, and for some time to come, conventional mineral fuels will meet the demand, approximately 75 percent of current output being produced by thermal generation. Hydroelectric plants provide the balance, and new systems of this type will be built. However, most of the available sites with natural differential heads already have been exploited, and greater expenditures now are required to provide adequate watersheds. Ultimately, diminishing returns may make it difficult to justify the necessary investment for hydroelectric development on the basis of power generation alone.

Several groups of manufacturers and utilities have been making studies in the field of atomic energy. Much progress is expected although it is generally conceded some years will elapse before economic production of energy from nuclear heat sources in competition with mineral fuels will become a reality. Research continues on the possibilities of utilizing geothermic energy and wind, wave, or tidal power. Harnessing direct solar energy remains to be achieved. Thus, mineral fuels must continue to carry the load within the foreseeable future.

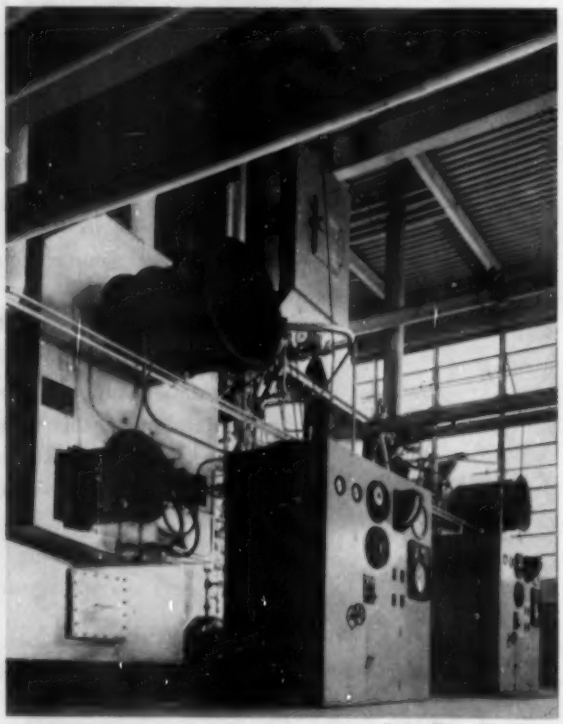
Utility Plant Trends

To meet this condition, the power field is striving to reduce losses in fuel recovery and treatment and to increase the efficiency of energy conversion, transmission, and utilization. In terms of current central station practice this means a tendency toward still larger units operating at higher steam pressures and temperatures. For example, turbines now are being produced which will have unit ratings of 185,000 kw and will operate with steam at 2350 psig and



Cyclotherm Division

Many plants use a multiple number of package boilers.



Bailey Meter Company

Standardized designs have integrated control systems.

1100/1050 F. A single shaft, 3600-rpm turbine rated at 250,000 kw and a cross-compound turbine with a capability of 260,000 kw, are in the design stage.

The reason for the trend to larger units at higher operating conditions is one of simple economics. Larger units cost less per kilowatt and are inherently more efficient. Higher steam temperature and pressure, combined with reheat, are used to reduce fuel consumption. In the next several years, larger units and temperatures to 1150 or 1200 F can be expected, although the kilowatt ratings of single machines probably will increase rather slowly.

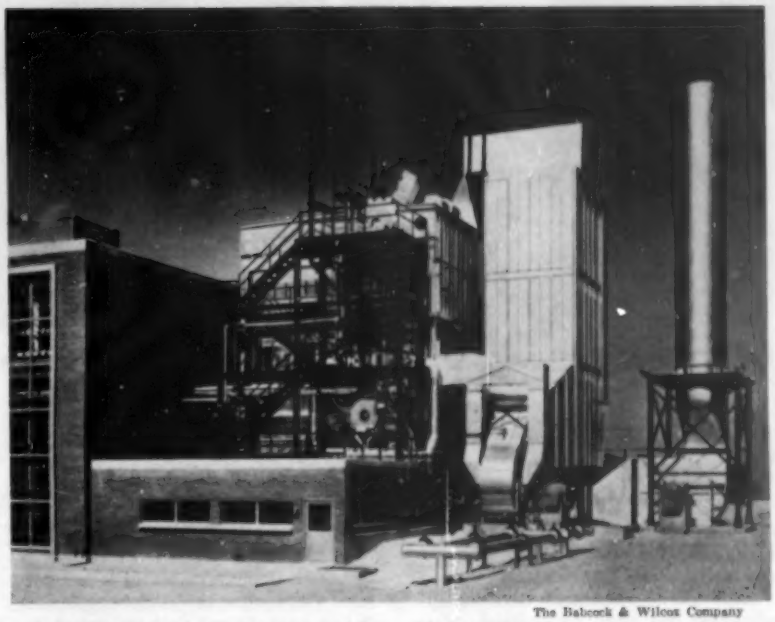
Currently there is talk of active design on a 200,000-kw turbine for steam conditions of 5000-psig pressure with 1200-F initial temperature and two reheat stages. One reason for considering such a large increase is that a really big step is necessary to make appreciable gains. Early calculations indicate that in comparison with a machine of similar rating but operating at 2000 psig and 1100/1050 F, a gain in over-all plant efficiency of 5 to 8 percent is anticipated.

Economy Gain

At first inspection this efficiency gain might not seem to justify the difficulties and construction costs which would be involved. However, a modern highly efficient 200,000-kw base load plant consumes approximately 500,000 tons of coal per year. With current fuel prices, this means an additional investment of about a third of a million dollars is warranted to gain one percent in efficiency. Since fuel costs show no disposition to stop rising, the urge to reduce heat rates is as strong as ever.

Boiler manufacturers will keep pace with the trend. Mercury boilers now are operating with tube metal temperatures of 1220 F and vapor temperatures up to 1000 F. In 1953 the first units for 1100-F steam temperature went into service. Most of the new steam generators employ reheat, and there is a wide acceptance of both natural and controlled recirculation type units for steam pressures in the range between 2000 and 2700 psig. Coal remains a major utility system fuel, with many stations using pressurized firing. Semi-outdoor construction has gained favor even for northern climates. During the last year the two leading boiler manufacturers announced plans for building units to operate at above the critical pressure, up to as high as 4500 or 5000 psig.

As operating conditions advance, the problem of selecting materials for steam generating units becomes difficult. Not only do metals oxidize more easily at higher temperatures, but the corrosive action of impurities, such as alkalis, sulfur, and vanadium in certain fuels, becomes more pronounced. Water treatment must be precisely controlled, and fireside surfaces must be kept clean. This has meant an increase in the use of soot blowers for greater dependability and versatility with lower maintenance. Many of these systems have automatic sequential controls to provide better operation.



The Babcock & Wilcox Company

Semioutdoor construction is receiving wider acceptance in the power field.

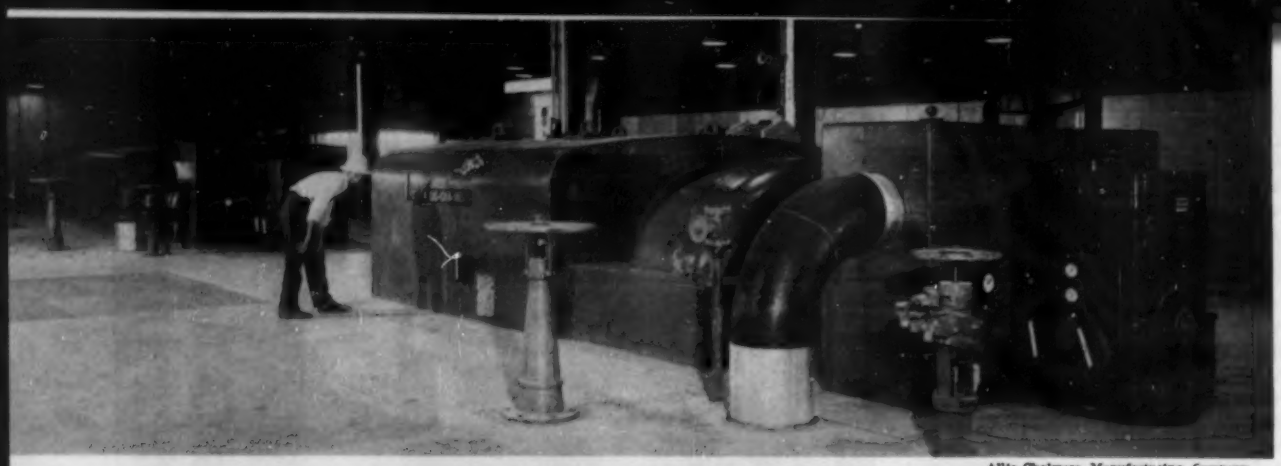
Auxiliary Equipment

Auxiliary equipment also will be affected by higher pressures and temperatures. As boiler pressures rise the energy required to inject water into the unit increases at a sharp rate. For example, servicing a 200,000-kw, 5000-psig pressure boiler with a conventional type of pump would require about 14,000 hp —and this is but one of the problems. Greater emphasis will be placed on firing methods, especially for low grade fuels. Reducing fuel consumption, minimizing fly ash discharge, and decreasing auxiliary power requirements will be the principal considerations, with the cyclone furnace representing the most recent development along these lines. Completely integrated boiler and turbine controls will be imperative because any such plant must meet the test of operational dependability and must be economically justified.

The phenomenon of "creep," or continued gradual deformation under long time stresses at high temperatures, has become more important in the design of valves and piping. At ordinary temperatures steels are elastic, deforming slightly under stress but resuming original dimensions when load is removed. When temperatures increase, continuation of stress produces a continued deformation. New valve designs using new alloys have been introduced to meet this condition. The trend is toward welded-in seat rings, welding-type pipe ends, and welded body-bonnet connections. Main steam lines follow the same pattern.

For some services there seems to have been an increase in the application of butterfly valves, particularly for such duties as pump discharge lines, water treatment systems, and hot air flow control. This design offers an excellent flow characteristic with low pressure drop. Rapid control can be obtained from open to close positions, and the design can be readily adapted to various types of positioning actuators.

High temperature operation also produced further development during 1953 of mechanical packings, gaskets, and oil seals using silicone rubber and fluorocarbons. It has been proven that silicone rubber will stand higher temperatures than other rubbers while fluorocarbons are unaffected by acids, organic solvents, and alkali solutions. Further-



Allis-Chalmers Manufacturing Company

Industrials with a favorable heat balance generate by-product power and utilize extracted steam for process operations.

more, at normal temperatures fluorocarbons have a low coefficient of friction. The long term trend will see a continuation along these lines and also more usage of mechanical pressure seals for rotary shafts in place of conventional packings.

Interest in insulation and its application has been intensified. New materials have been introduced, and application of well known proven materials continues high. Possibly the greatest advances have been the series of new application techniques which have been developed and the growing tendency toward simplified dimensional standards for pipe insulation. The multiple layer, broken joint method of installation remains the most favorable because it minimizes expansion losses.

In many instances, furnace designs have been modified and improved to increase the efficiency of operation and permit more flexible use of available refractory materials. There has been widespread use of both heavy and insulating type castable refractories and molded materials. For many auxiliary applications, linings sprayed on with a pneumatic gun are proving advantageous in the prevention of corrosion.

Control Systems

Modern steam generator designs demand much more complex control systems. Reheat sections, multiple furnaces, and the use of multiple fuels inflict a much stronger requirement for precision control as deviations in performance cannot be tolerated under today's severe operating conditions. Transmission of signals and control response must be fast, with many plants installing the control equipment at the point of measurement and centralizing indicators, recorders, and control point setting devices in the main control room. Signal lines are being held to minimum length and electronics are helping to prevent transmission lags.

While the trend toward centralized control rooms is very strong, the argument for and against the "graphic" panel continues. Even enthusiastic proponents acknowledge its limitations in the power field, although opponents admit it has definite virtues for some circumstances. It has been found that too great reduction in the size of instruments defeats its own purpose as it prevents the operators from being able to read instruments readily and accurately. A satisfactory compromise on size is under way.

Future developments will probably be limited by the ability of manufacturers to produce reliable performance with the complex control systems that will be required. A marked increase in the use of oxygen meters as a combustion guide, particularly for multiple fuel fired installations, can be expected. The use of electronics will be more widespread. The trend to smaller but adequate instruments, panels, and control rooms will continue, and the number of installed instruments and controls will grow in an effort to save labor and to meet the exacting demands of modern designs.

Industrial Plant Trends

The trend in industrial plants can conceivably be characterized as a partial reversal of tendencies in utility stations. While there is currently over 15-million kilowatts of generating capability in industrial plants, more and more companies are finding it advantageous to purchase power requirements from utility systems. Those industries with a favorable heat balance for by-product generation will, of course, continue to produce power. However, many authorities feel that unless the investment can be retired within a five year amortization period the installation of generating equipment is not justified. This well may be a very short sighted attitude in view of the advances that have

Automatically controlled spreader stokers cover a wide range of capacities.

The Hays Corporation

been made in even small condensing turbines and the progress that is evident in the development of other types of generating equipment.

Standardized Boilers

Strongest trend in the industrial field at the present time is to the utilization of package steam generating units. Modified Scotch marine boilers, water tube units, flash type packages, and controlled recirculation generators are all finding wide application. Even in plants requiring relatively large amounts of steam there is a tendency toward the use of a multiple number of standardized units to increase the flexibility of operation and control. As this trend grows, there probably will be more wide scale introduction of designs utilizing thermal liquids to eliminate the high pressure problem at high temperature demands.

Standardized designs provide many advantages. In the case of shop assembled units, the purchaser can be assured of receiving a carefully produced item which is fully insulated, mounted on a structural steel base, and equipped with all necessary control and safety devices. Installation time is reduced to a minimum and very little auxiliary equipment is required as most of the designs have self-contained mechanical draft equipment which obviates the necessity of tall stacks. Even many of the larger sizes, which require field erection, are fabricated from standardized components.

Fuel Consumption Trends

The increased use of package boilers has had an adverse influence on the coal market. Most units are oil or gas fired although some engineers envision a possible use of automatically fired pulverized coal for some designs. In other types, stoker firing is already available.

Larger plants are using spreader stokers to advantage in capacities up to 400,000 lb per hr. Increased application of spreader stokers in even the smallest plants can be expected when the recent developments in self-cleaning units as small as 5000 lb per hr become more fully appreciated. Improved low load operation, reinjection procedures, and dust collection methods enable spreaders to efficiently satisfy smoke abatement ordinances.

One prime fact which cannot be ignored is that coal constitutes more than 90 percent of the known, recoverable fuel reserves in this country. Thus, coal utilization will grow, particularly as conversion programs progress. Underground gasification and hydrogenation present vast possibilities. In the future hydrogenation plants can be expected to fill any gap created by declining oil and gas resources through production of synthetic gasoline and related fuels while recapturing a certain volume of chemicals.

Minneapolis-Honeywell Regulator Company

Graphic panel with miniature recording instruments typifies modern design.

Diesels and Gas Turbines

In the diesel field the principal trend has been toward the conversion from straight diesel to dual fuel operation and the burning of residual fuels. Increasing electrical loads have caused more power shortages than realized, and many diesels have been installed for both primary and standby generation. Standby units have become particularly important for such vital applications as supplying emergency power for fire protection, communication, and airport lighting systems.

Gas turbine development is finally progressing, having been accelerated by military and commercial research during World War II. Many observers believed the transition from specialized military applications to practical commercial usage would be extremely rapid. However, while significant advances have been made there are still many hurdles to cross before the gas turbine can fully capitalize on its small volume and weight per horsepower. Development engineers do not look for the gas turbine to be a cure-all type of prime mover, but for it to find its logical place among other types of power generators where it can be economically justified.

At the present there are 10 gas turbine locomotives, 15 electric power generation units, and 35 mechanical drive units in service. Experience with these installations and other pilot plants indicates that to achieve a satisfactory economic balance, the use of residual oil or coal must ultimately become feasible for some designs. When heat recovery is utilized, the higher thermal efficiencies often justify operation on distillate fuels. Further development can be anticipated in the future, especially in improved designs to permit utilization of low grade fuels. Package units are on the way, and modified cycles including combination of gas turbines and steam turbines already are contemplated.

One possible future development is the application of free piston-gas turbines for power generation. This arrangement appears to offer greater simplicity of mechanical design than the conventional diesel engine and has a higher theoretical efficiency than the simple gas turbine. Unfortunately, no practical applications have been made in this country to date but the potential is interesting.

Possibly no single group faces a greater challenge in the immediate future than the power industry. To them falls the responsibility of supplying the electric and steam services which are necessary to develop, perfect, and mass produce new commodities. That they are capable of accomplishing this end is well evident from the technological progress they have achieved.

Generators and Motors

I&P Annual Review

Trends in generator design point to improved gas cooling techniques. Small motors will soon appear in the new re-rated sizes.

THE ELECTRIC GENERATING and utilization capacities of this country show no signs of slowing their rates of growth. We are in the home stretch of the 1945-1955 era in which our generating capacity will more than double. Industrial power growth contributes to this trend though the rate of central station growth is greater than of industrial generating facilities.

Presently, industrial generating capacity represents 15,700 mw of the nation's total 103,300 mw. The order of magnitude for monthly production of electric energy by industrial concerns is 5.9 billion kwh; utilities are generating some 37 billion kwh monthly. The increase in generating capability is certainly not being made by adding units of constant design. Rather there appears to be a continuing effort to jam more capacity into smaller packages. Development and application of new materials has been the key to success in this effort.

The immediate object of attack by designers is generator cooling. The trend to hydrogen for turbine generators rated 16,500 kw and higher is firmly established and seems to be entrenching itself even deeper. Hydrogen is being put into stators and rotors in the generators. One firm (Allis-Chalmers) has introduced hydrogen jet cooling of bushings. The faster removal of heat permits reducing the size of large capacity bushings.

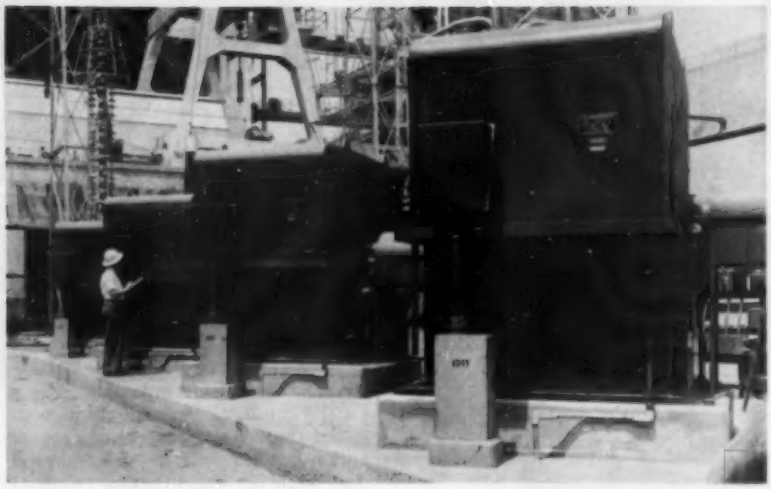
High Pressure Hydrogen

High pressure hydrogen is being circulated through stator and rotor windings in direct contact with conductors. Other designs incorporate hydrogen pressures up to 45 psig. Thinking now leans in some places to manufacture of generators with hydrogen coolant pressures of 60 psig in the near future. Designers are thinking beyond even these levels; some look to hydrogen pressures up to 95 psig.

Turbine-generator units are getting more attention. Gear connections will probably be used to permit operating the turbine at higher, more efficient speeds. Outdoor units have proved successful and certainly require smaller investments. They have particular advantages where an assured constant supply of natural gas is available and where weather is not too severe. Packaged

Westinghouse

These turbine generators are rated 5000 kw at 6900 volts, 60 cps; the units supply process steam at pressures of 50 and 150 psig. This installation is at the Rock Hill, S. C. plant of the Celanese Corporation of America.



Allis-Chalmers

These outdoor induction motors are used to drive circulating water pumps in the Southwest; they are rated at 900 hp at 435 rpm and 4160 volts.

gas turbine-generator units are coming out.

The demand for direct current will definitely increase as the electrochemical industries expand. Each class of rectification equipment for general industrial use will most likely hold its own position in the field except where some extraneous factors may be involved. For example, the trend to overhead mounting of rectifier substations and similar equipment often rules out the use of rotating equipment in the minds of many plant engineers. It is simply too inconvenient to service rotating machinery mounted in overhead locations.

Rectification equipment is following the general trend toward "packaging." Completely pre-wired units are being supplied within their own enclosing cubicles. These rectifiers have advantages of simplified installation and maintenance, better availability of original and replacement components (on account of manufacturer's standardization), and a high degree of adaptability to modification and re-location in case of plant layout changes. All these factors work to reduce the cost of installed capacity delivered by package units.

Motors

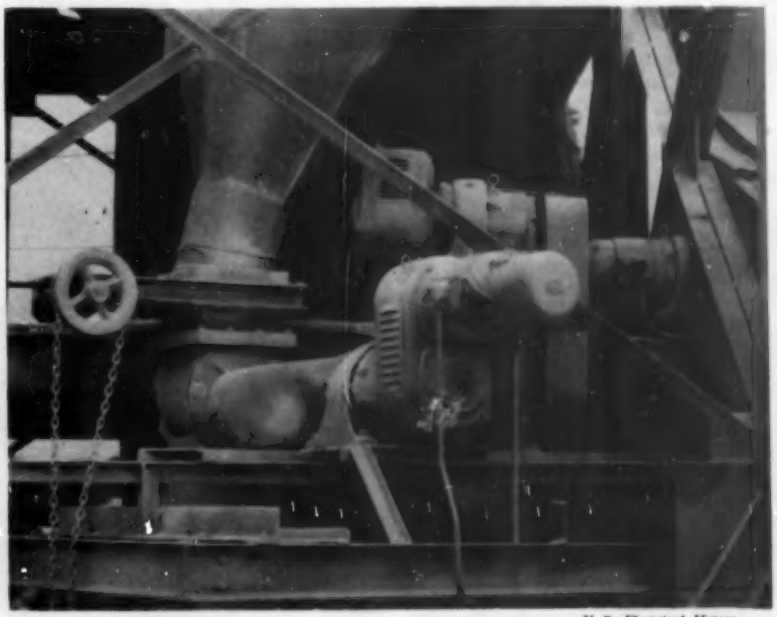
There are rumblings of a renewing interest in d-c power for motors, an interest which may accelerate soon. The advantages of the fine and critical control offered by d-c motors have long been acknowledged; this kind of motor response will be more in demand as factories continue the march toward automation. It may be that increased awareness of d-c motor performance may encourage further steps to make d-c supplies even more attractive.

Some 5000 motors are manufactured in this country every working hour; a considerable portion of these will go into washing machines, clocks, and the like. None-the-less, an appreciable number are being built for use by industry. The year 1954 will see the first of the new a-c motors coming out under the recently approved re-rating program. The new NEMA standards put greater power into given frame sizes in the 1- to 30-hp range. The smaller sizes, frame diameters 182 and 184, will be available during the first of 1954, larger sizes will follow at 5-month intervals.

Better materials, increased cognizance of ambient conditions, and improved fabrication methods are giving motor users more value for their money. The re-rating program will probably not mean lower prices for a motor of given horsepower; rather, it will mean that any price increases which may have been imminent will be postponed, if they are made at all.

Other trends show increasing awareness of enclosure types and more emphasis on outdoor applications. The weather-protected outdoor motor is gaining more and more favor, permitting cheaper installations of powered equipment. Motor sizes are also increasing; 3500-hp boiler feed pump drives and 3000-hp induced draft fan drives are in use. Several 4000-hp pump drives are now on order.

Other improvements in motor design are coming in ventilation systems, bearing lubrication and noise suppression. One manufacturer (General Electric) is tackling the noise angle by reducing bearing rattle, magnetic hum, and windage.



U. S. Electrical Motors

Motors with variable speed drives are used here to drive conveyor equipment for feed screens, grinders, sackers and other requirements.

Heating and Air-Conditioning

I&P Annual Review

Comfort consideration is the next phase in industrial air-conditioning. Proven successful in restaurants, offices, and homes, it should help raise the plant morale and working efficiency.

INDUSTRIAL HEATING has seen few major changes in the past ten years and there is little to suggest any basic developments that will broadly affect the immediate future. It seems that it will be some years before atomic energy or solar energy will replace coal, gas, or oil as a source of fuel for heating. And similarly, "radiant" panel heat or electric induction heating is still a long way from challenging the pipe convector or unit heater in actual number of installations.

As an interesting sidelight on atomic energy, the Hanford plutonium-producing plant at Richland, Washington, will shortly utilize large quantities of waste heat developed in atomic reactors for heating buildings. This is the first attempt in this country to use atomic energy for heating.

Unit Heater

The unit heater continues to dominate the field of industrial heating. To meet industrial requirements, the unit heater manufacturers are constantly increasing the range of available sizes of units.

Lighter metals and more compact designs have made possible lighter weight units. One manufacturer has stated that his new 609,000 Btu heater weighs only 294 lbs against a previous 540 lbs. The lighter weight will ease problems of mounting or suspending the unit heaters from walls and ceilings.

Gas-fired unit heaters are gaining popularity. Also installations using bulk LP (liquefied petroleum) gas in conjunction with regular gas have proven cheaper in certain localities of the country.

Some argument has arisen over hot water versus steam unit heaters. The proponents of hot water heat favor it because of the elimination of steam traps, the fact that higher water temperatures can be used with the new type unit heaters, and because of better thermostatic control.

Insulation

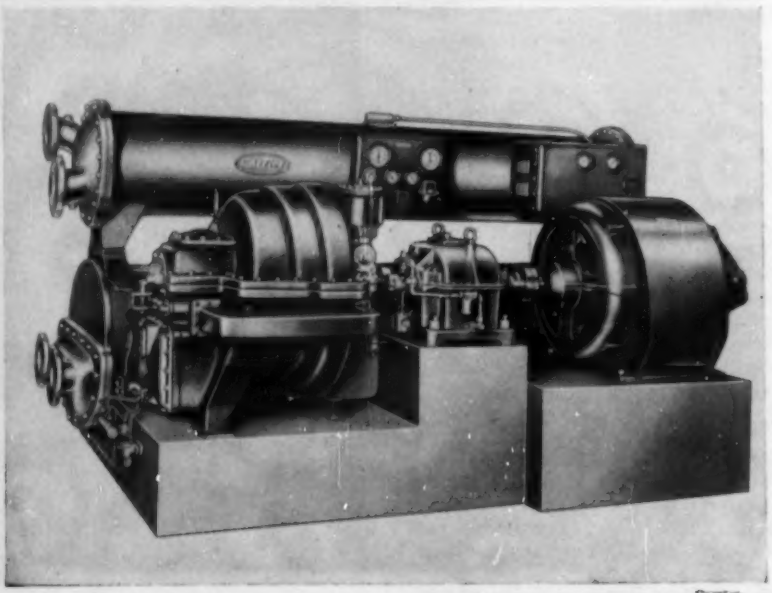
The trend in insulation is towards the development of dual purpose insulating materials which will keep heat in a pipe or duct under one set of conditions and will keep heat out under a second set of conditions. This is the result of the use of dual purpose pipes in air-conditioning. Indications are that dual purpose insulations will gain acceptance in the air-conditioning field.

Air-Conditioning

Air-conditioning has made some big strides in industry. But according to the equipment manufacturers, the biggest strides are still to come. One of the most important will be air-conditioning of industrial plants for the comfort of employees as well as for the desired control of process operations. It will be remembered that while air-conditioning received its initial stimulus from those industries using hygroscopic materials—textiles, printing, chemical, leather, and others—who saw the value of air-conditioning as a means of improving and controlling their processes, the trend toward comfort conditioning is something relatively new in industry.

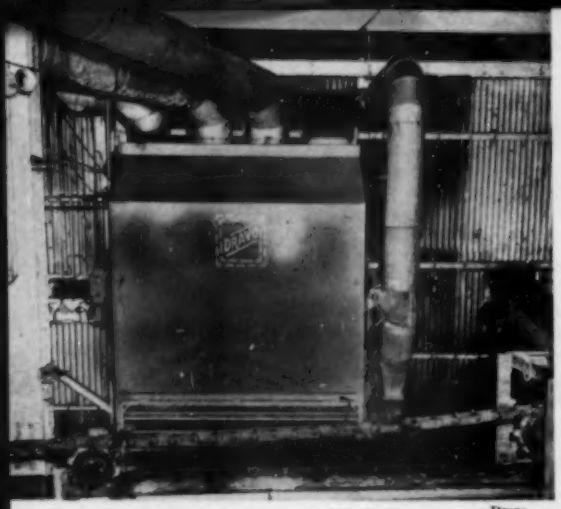
Promoting the Trend

Two factors are considered extremely important in promoting the trend. First, the continuing movement toward higher per man production levels with emphasis on volume and low unit cost. In operating terms it means faster machinery and more intense lighting with the resulting greater heat load. At



Carrier

Development of smaller centrifugal compressors means air-conditioning systems (75-100 tons) can now use centrifugal as well as reciprocating machinery.



Dravo

Counterflow heaters force warm air through ducts to heating outlets in the building.

York

An air-conditioned press room minimizes troubles due to temperature and humidity.

the same time, these high levels of production call for a greater degree of efficiency and proficiency on the part of the operator. Air-conditioning seems to be one answer to these problems of heat load.

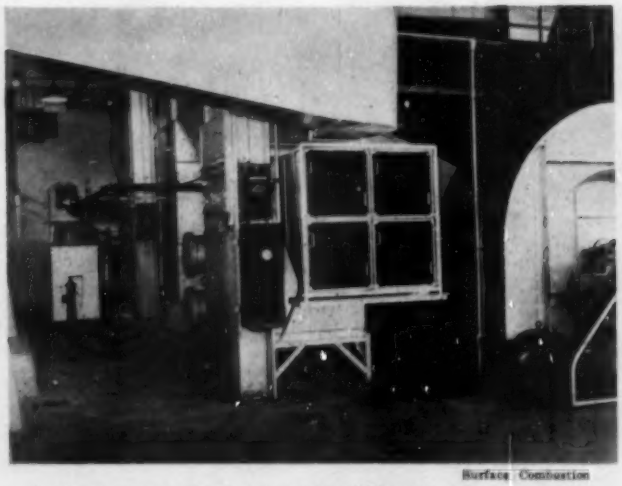
The second factor is that people have become accustomed to conditioning in offices, stores, and in many homes. It is logical that these people will want air-conditioning for their working environment. One air-conditioning equipment salesman has been successfully selling industrial customers by showing how much greater savings through worker efficiency can be expected by installing air-conditioning in the factory (with its generally speaking higher wage rates) than in the offices (with their lower salaried white-collar workers).

Where processing permits, industrial systems will be designed to maintain very close to ideal comfort conditions of temperature and humidity. As an example, the textile industry, which has been widely air-conditioned but with emphasis on humidities desirable for processing and using only evaporative cooling in many installations, has been installing refrigeration at a fast rate since World War II. Part of the reason for this growth has been the need to establish greater working efficiency for personnel.

Other Factors

More installations will use high-velocity ducts which permit existing buildings and plants to be completely air-conditioned without loss of valuable space.

A greater number of air-conditioning systems from 75-100 tons of capacity and upward, will use centrifugal rather than reciprocating refrigeration. The recent development of smaller centrifugal machines has extended the substantial benefits of this type of cooling, such as long life at high efficiency, low maintenance and compactness in



Surface Combustion

A chemical absorbent drier dehumidifies air in a match factory to create proper drying conditions for the processes.

Armstrong Cork

A newly developed insulation that is molded on fittings for cold lines cuts costs and speeds construction.

the construction of the units.

An increase in the use of water conservation equipment and methods, such as cooling towers, and spray ponds, is foreseen. Thickly populated areas requiring more water, localities where water costs are high, and places where there is difficulty in disposing of the water, will continue to help promote this already prominent trend.

There have appeared on the market industrial air-conditioning units which require no water, but are designed to use air as the heat-transfer medium in the condenser. Further development work will undoubtedly result in greater application of this type unit, especially in water scarce areas.

Where a constant year round chilled water supply is necessary —for air-conditioning or for process cooling—steam jet water vapor refrigeration is gaining ground because it requires only steam and water and is cheap to operate.

Humidity Control

The dehumidification field, as part of the larger air-conditioning industry, continues to take a more important place in industrial installations. Interest in humidity control equipment has increased in industrial applications which have become more conscious of expensive humidity damage during processing and storage of moisture sensitive products. Use of dehumidification equipment has particularly increased in conjunction with air cooling equipment. Sometimes it has been found more economical to use cooling equipment for temperature control only and to used dehumidification equipment separately for control of low humidities.

Applications

With the emphasis on high quality in the more competitive market, such industries as food and candy are particularly aware of freshness and crispness in moisture sensitive products. For this reason, interest in dehumidification equipment for processing and storage has been particularly noticeable. In laboratories and chemical plants a larger field of new moisture sensitive products call for an increasing number of controlled drying cabinets and rooms in which temperature and humidity can be held at definite precise levels.

The trend toward greater use of humidification, primarily during the winter heating season when indoor air reaches very low humidities, has resulted partly from a growing recognition that humidifiers successfully reduce production, material, and finished product losses.

A few examples: Woodworking plants need humidification to prevent warping, shrinkage, glued joint failures, and poor finishes. All plants storing paper bags, boxes, and other containers, find that humidifiers prevent cracking, tearing, and breakage. Leather working plants require humidification to prevent leather from cracking and to keep it pliable. Humidifiers are needed in food plants to prevent weight loss and deterioration. Printing and paper converting require humidification to prevent printing and scoring difficulties which can be costly.

It has also been shown that humidification in wintertime, by helping to reduce respiratory diseases, can decrease absenteeism among employees giving further savings.

As further applications and benefits of humidity control became apparent, the trend towards increased use of humidification or dehumidification equipment should continue. This has been the pattern of past years and seems to be gaining momentum for the coming years.

Humiduct units maintain proper humidity conditions in this cotton spinning room by a system of horizontal circulation.

Dahmen

Instrumentation and Control

I&P Annual Review

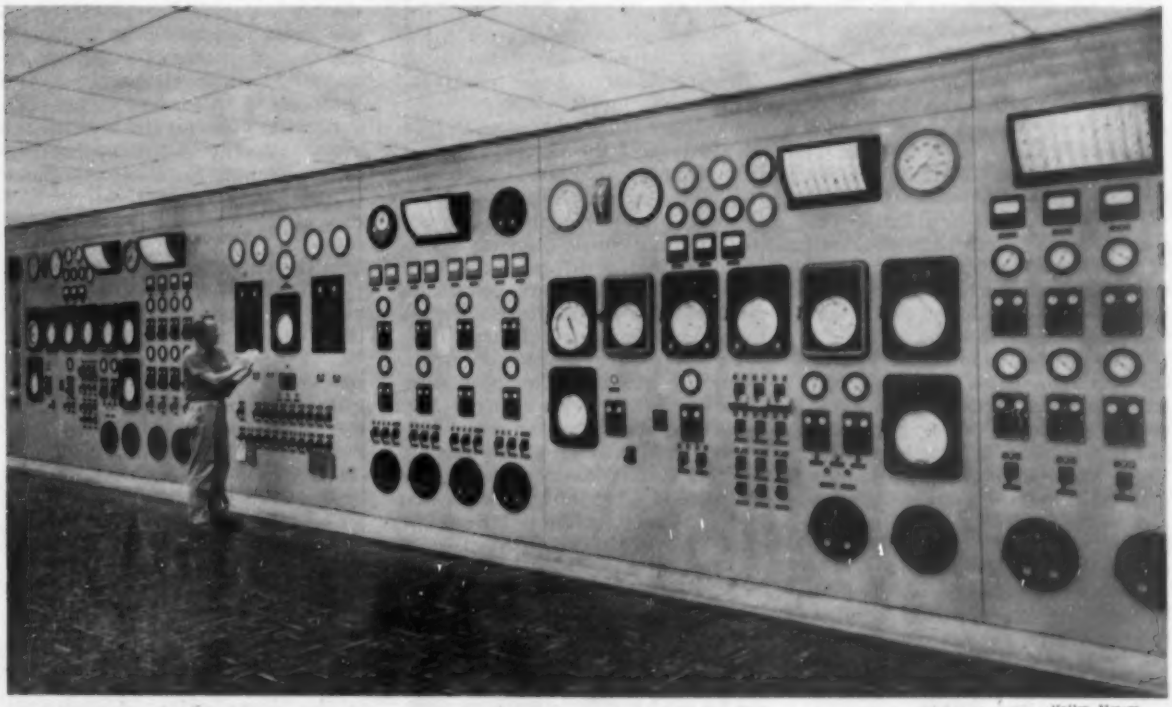
A wide variety of operating capabilities can be put into a control system by picking and choosing wisely among the many devices and hook-ups available.

PRIOR to World War II, expenditures for automatic recording and controlling equipment represented some 1 to 3 percent of the total capital expenditures for machinery and equipment; if our improving technology maintains the pace it has set for itself, the figure should rise to 15 percent within the next several years (Minneapolis-Honeywell Regulator Co.). And the percentage will apply against higher actual dollar expenditures.

Presently, about seven or eight percent of capital equipment funds are allotted to automatic control and recording systems. The trends represented are unmistakable. For one, telemetering techniques are coming of age; centralized control rooms are fed data by low-pressure air and low-voltage electric signals, vastly simplifying connection problems. The modern control room is thereby safer and less costly than if expensive and extended high-power signals were used.

The central control panel has evolved out of sheer necessity. Recording and control devices have been miniaturized simply because so many are involved in today's plants that something had to be done to bring the irreducible minimum number within seeing range of the operator. Modern control problems call for self-correcting servomechanistic systems simply because one man cannot comprehend, much less act intelligently on, the huge masses of information which must be coordinated if optimum relations between rates, quality, and costs are to be maintained.

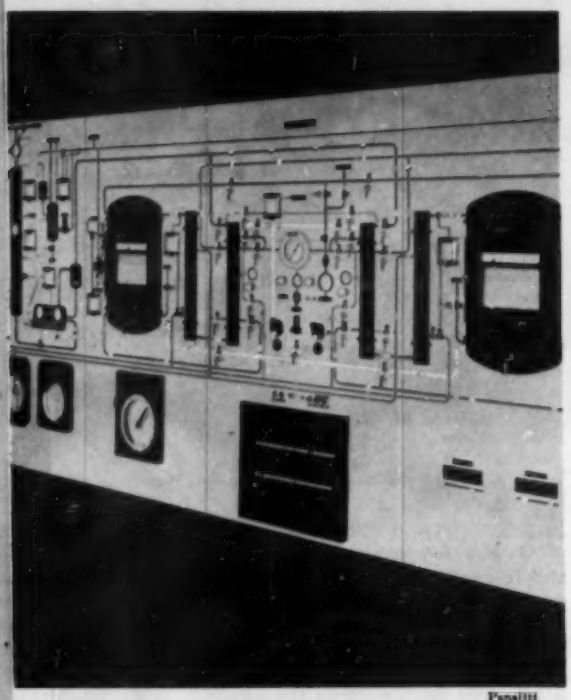
The problem facing the users of instrumentation and control today is how far to go in installing fully automatic, feedback (closed-loop) systems. In power generation, for example, it is generally agreed that a self-regulating steam plant is within the realm of possibility and that it will only be a short time before a plant can be built which could run itself. But concommitant with this is the problem of failure in the instrumentation and controls themselves. Consider, too, a normal plant failure without a human operator in "participating" attendance (as opposed to casual "caretaking" with primary reliance on the "system"). Might it not take longer to ferret out a fault upon an alarm than if humans had been retained as neces-



Bailey Meters

This control panel illustrates the sizes to which conventional panels are forced as operating units grow more complex.

General Electric



Panelit

The introduction of miniature instruments made the graphic panel possible coordinating displays of data. Metal-clad switchgear carries instrumentation on front panels. Men are examining recording watthour meters.

sary, continuously watchful elements operating within the plant control system all along?

Packaged Systems

One firm has announced that "packaged" control systems will be available so that users can select a complete system on the basis of over-all function. Matched control units will be produced for all industries from ceramics to utilities. The theory is that some basic problems of instrumentation and control are the same—for batch cooking as an example—whether found in the textile, chemical, or food industries.

There is the problem of sensing the data upon which the control systems act and in carrying out the system's orders. Strain gages are put on crane hooks to measure the weight of the lifted load by the strain induced in the hook; strain gages are also being used extensively in continuous weighing systems. Transfer switches are being made available to automatically bring power in from an alternate source immediately on failure of the normal source; the switch is designed to neglect momentary voltage dips and to respond only to an actual outage.

A definite trend is developing in the use of solenoid-controlled valves to be actuated by signals from central control panels. However, for the fast response required for throttling applications, pneumatic valves are still preferred. Some consideration is being given to electro-pneumatic units; so far, the short response time of the pneumatic valve is unequaled by electric ones. Infrared analyzers are being used to determine product quality in intermediate and final products as a means of fixing in-process control. Radioactive isotopes are being applied to measure in-process thickness and weight per unit area.

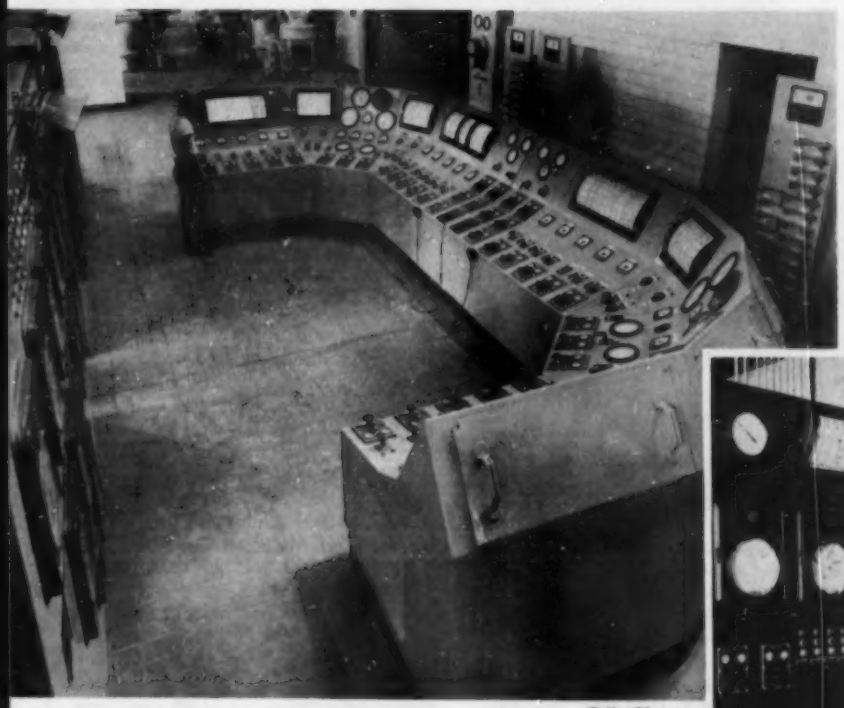
These are a very few of the devices which are making their appearance as an outgrowth of the swing to automatic control. They represent but a small fraction of the varied sensing and responding devices which are required to pick up significant information and to implement action directed by the control system.

Machine Tool Control

Machine tools have been becoming automatic by increasing degrees for some time. But the latest talk envisions that different piece parts can be produced by a machine with control stemming from data on punched cards or magnetic tapes. Magnetic tape control for the direction of a machine or process cycle has been announced as available; any motion or control which can be operated from an electric signal can be operated by the new device. The first unit will operate a one-hour cycle. Possible future applications include milling machines and flame cutters. Programming can include control of temperature, pressure, conveyor speed, valve positions, fluid density, and others.

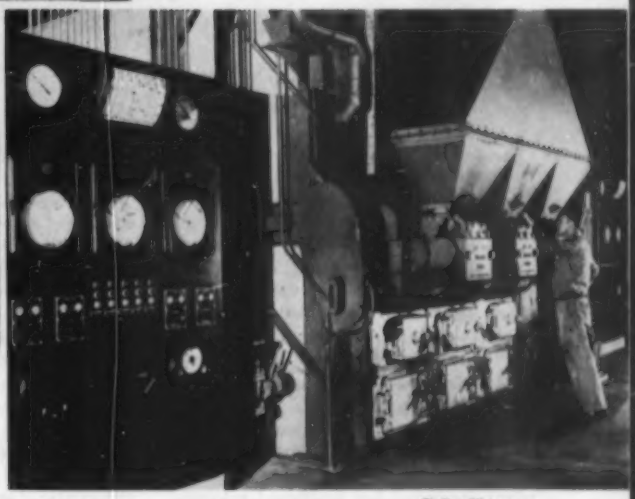
No one group is more keenly aware of instrumentation limitations than engineers themselves. The virtues of simplicity work to the advantage of the over-all control system and most engineers realize this. The ASME was told by Otto Svoboda of the E. W. Buschman Co., "If a simple electric controller or limit switch will (do a job), don't insist on electronics. If the movement can be accomplished by a simple lever arm mechanism, don't use hydraulic, air, or electric energy."

The following report partially answers the question of fault location. "We do notice some trends in the industry which are natural due to the complexity of electronic equipment — for example, we are



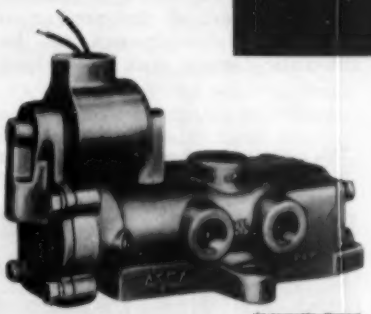
Bailey Meters

When units are small and not very complex, instruments and controls can be easily located nearby (below). But for more complicated systems, huge console-type desks are used (left). Vital operating information is brought to the console itself; data of less urgency are shown on the upright panel board, left.



Bailey Meters

building more and more test apparatus and automatic testing circuitry into our equipment. This makes it easier for the semi-trained or inexperienced servicemen to locate and fix troubles as they arise. As an example of this, we built an axle-hardening machine which has an annunciator system to indicate lack of water pressure, oil pressures, or improper positioning of the work piece; if for any reason the machine fails to operate correctly, the operator immediately knows where to look for the trouble." (F. S. Mabry, Westinghouse)



Automatic Switch

This four-way solenoid valve implements control system functions.

Scanning Systems

The attack on complexity (without limiting centralization of control) through the use of scanning systems is gaining momentum. Many more functions can be recorded and monitored by using sequential scanning systems and multi-point recording. Economy is one virtue; one firm estimates the order of cost would be $45 per point with commercially available temperature systems. The present systems can handle 24 or more points. Additional capacity comes from the sequential sensing of many points with the data displayed by a single device. The net result is a reduced number of displays commanding the attention of the operator.

The experience of the past shows a gradual development away from control systems which were merely tacked on to plants after they were set up; then, the control system only verified what the designers and operating men thought should be going on. Trial and error methods later took over, showing some sophistication when representative equations were introduced and when such concepts as lag and storage capacity were acknowledged.

Next evolved the step-change control methods. However, errors were observed and compensated through the mechanism of an intermediate human. But when the burden of correlation for one human became too great, and the coordination of several humans became too much of a problem, the need for automatic control had arrived. World War II was responsible for accelerating the developments of servo-mechanism techniques to meet present needs.

Now systems exist for sensing dynamic functions in the process of change, for predicting future behavior, for making anticipatory corrections, and for seeing that such corrections are adequate. Design of these systems is often undertaken concurrently and in cooperation with instrument manufacturers. It remains for the user to determine how far along this path he has progressed with his own control problem and to determine how much of the available sophistication he wants and can economically justify.

The instrumentation and control industry is now in a buyers' market status and it is expected to stay that way for some time to come; competition will only get tougher. Therefore, the buyer is in the driver's seat and it is he who will make the decisions as to how far industry will go in taking advantage of automatic control techniques and as to where the break-even cost level exists.

Materials Handling

I&P Annual Review

Developments indicate a strong trend toward integration of all types of handling equipment into smoothly operating teams, each part doing that job to which it is best suited.

THE TRUE OBJECTIVE of in-plant materials handling is the reduction of production costs. It has often been said that the job of the materials handling engineer should be to put himself out of business—that the best materials handling system is "no handling." Carried to its ultimate end, this objective is unquestionably worthy, but in some instances the system designer or plant manager has confused materials handling costs with production costs and has found too late that in reducing handling costs, total production costs have increased, thus defeating the true objective of materials handling.

For example, the in-plant cost of materials handling is low when materials are stored in the railroad car in which they are received until they are needed on the production line, thus making but one trip directly from car to production machinery. However, demurrage cost might be so great that final production costs would be increased. Similarly, it is often found more economical to move materials over longer distances several times rather than to redesign a major production line or remodel a plant in order to shorten the distances involved. In short, sometimes it has been found best to increase the costs of materials handling equipment in order that the over-all cost of the product might be reduced.

So, engineers are learning that the least handling is not always best.

Automatic Factory

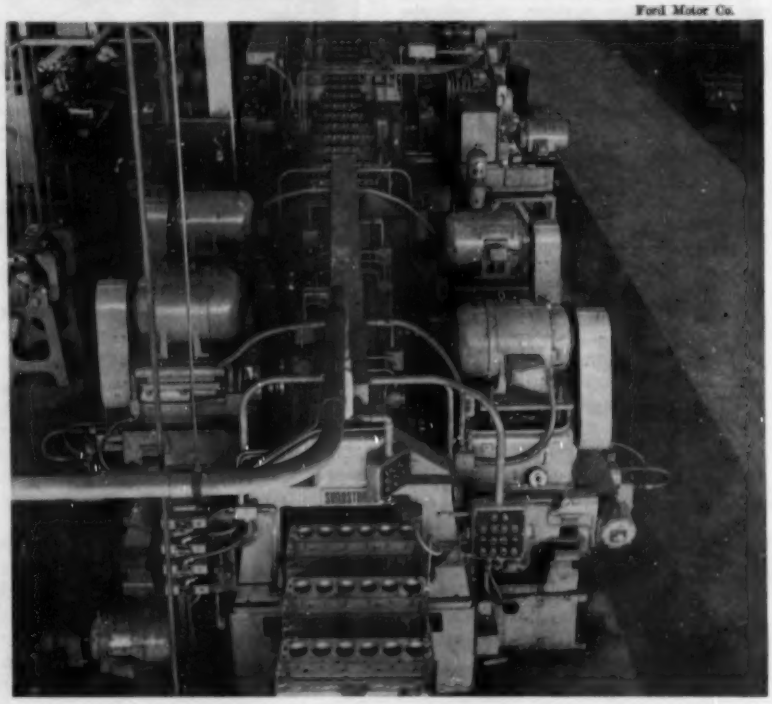
They are also learning to see materials handling as a basic part of the production operation—as a production tool—rather than as a necessary evil. This aspect of materials handling has become a major trend in the past year and promises to be the big news in the years ahead. In the automatic factory or on the automatic production line, the conveyor is the basic machine about which the production equipment is built. In fact, the conveyor becomes so much a part of the production and assembly equipment in the automatic factory that in a long article in the October issue of *Fortune*, entitled, "The Automatic Factory," the phrase "materials handling" was not mentioned once in the whole write-up. While materials handling was a major consideration in the topic being discussed, the conference reported in the article lost sight of the conveyor because it had become such an integral part of the production line. Some automation engineers even object to the use of the word "conveyor" in this type of application.

This brings up a new concept in materials handling. No longer can it be thought of as that part of manufacturing in which cost is being incurred without any value added to the product. In the automatic production line, value is being added at every step, and the steps are so closely fitted that handling is reduced to mere positioning. There arises the question as to whether the conveyor has become a part of the production line or whether the production line has become a part of the conveyor.

All too frequently the process engineer calls upon the plant engineer to provide automation without understanding that a sensible system requires redesign of the production line, itself. For example, the machining of a complicated part may now be arranged so that the part is

This cylinder block machining operation in the Cleveland Plant of Ford Motor Co. is often used as an example of automation. Note operators in upper left of photo.

Ford Motor Co.



machined first on one side and then on the other, then changed to still other opposite positions for subsequent steps. Such movement does not adapt itself to automation. First, the process steps must be rearranged so that turning, lifting, tipping, and shifting are reduced to a minimum, and then must proceed in an order that requires the least repositioning from step to step. This means that the plant engineer and the process engineer must work together if handling and processing are to be integrated.

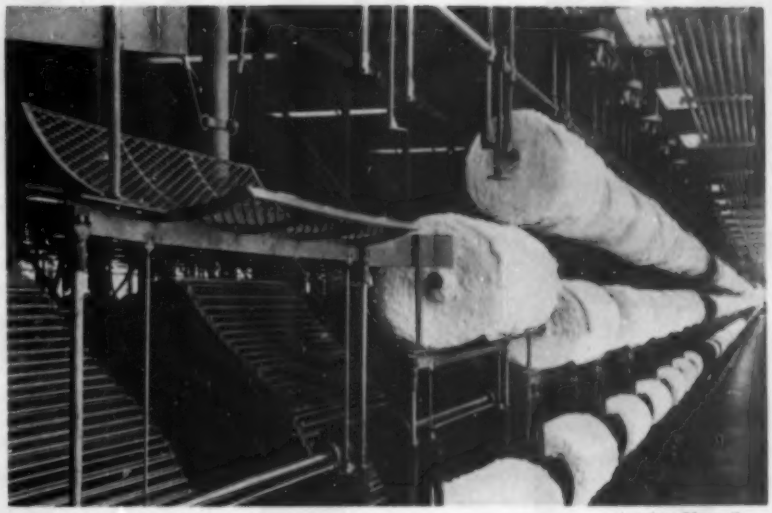
Automatic Inspection

Of more immediate importance (the automatic factory is still a long way off in most industries) are other trends involving products and ideas now available or in the development stage. Automatic inspection, testing, and rejecting methods are now being adapted to materials handling systems. The automatic acceptance or rejection of an item on the basis of weight is commonly applied in a number of industries. For example, in the textile industry, laps (rolls of light, fluffy cotton batting or other fiber taken from the bale opening machines for delivery to the cards) are being handled on over-head trolley conveyors which run over a section of track so arranged that on this section they are weighed and the weight recorded on a tape. If they are over- or underweight the record is printed in red, and the defective lap is automatically shunted onto a spur monorail so that it can be re-run.

Wherever weight is a measure of quality, automatic acceptance or rejection is easily arranged for a great many types of conveyors. Other physical characteristics can also be used as inspection criteria, and the handling system can automatically reject those which do not meet the standards. Size (as in grading coal, gravel, and fruit) has long been used, and color, shape, and even texture can be automatically inspected. Radio activity can also be employed to obtain automatic and accurate inspection results.

Storage in Handling

Conveyors are also being used more as live storage. Continuously moving trolley conveyors are frequently used for storage purposes. Items hung from carriers move through the plant with only those currently needed being removed at various processing stages. The excess continue to go on their way, not to be taken from their hangers until they have completed the circuit once or many times. In fact, the handling system need not be continuous to be used as storage. Bulk materials handled in special containers designed to be carried on monorails are frequently stored on shunt loops designed solely for this purpose. When needed, they are moved back onto the main process line.



American Monorail

This monorail system delivers cotton laps from opening room to cards. This type of system not only delivers materials but provides considerable live storage.

Gravity wheel and roller conveyors—and to some extent power conveyors as well—also have an important place in storage-production operations. In many plants, materials are removed from stockpiles and loaded on conveyor supply lines which lead directly to work stations in the plant. As goods are removed from the line and processed, others move up automatically so that operators need not leave their machines or wait for luggers to bring materials to them. Down time is thus kept to a minimum.

Flexibility

While the trend toward the use of specialized materials handling equipment continues, there is a trend, as well, in the opposite direction. This is the trend toward flexibility. The disadvantage of automation is its inflexibility. Even a slight design change in the product may require a complete and expensive redesign of all the handling equipment, and the more automatic it is, the more extensive the redesign required. Imagine the expense involved in changing the Ford production line in the Cleveland Engine Plant from a six cylinder to an eight cylinder design. This new plant is frequently used as an example of the automatic operation, and a change in engine design would obviously be costly.

The trend to flexibility leads back to the industrial truck, which can "go anywhere and do anything." This machine of all work has been developed to a point scarcely suspected ten years ago. It can be adapted to grab, lift, rotate, and position. Special attachments will handle not only pallets, drums, coils, and bales, but bulk materials or odd shaped parts.

Wherever heavy, bulky, unit loads are to be moved, or wherever there is a wide variety of shapes, weights, and sizes to be handled, the industrial truck is a necessity. The manufacturers are bringing out new models every month, some designed for special jobs, but even more being designed for increased flexibility by the addition of special attachments.

More and more emphasis is being placed on flexibility in the power and gravity conveyor field, too. Plant conditions change, and conveyors must be designed to operate under the new conditions with a minimum of time and expense. One manufacturer (Rapistan) has designed several belt conveyors that can be lengthened or shortened in the field by adding or removing sections of bed and belt. This feature eliminates sending equipment back to the factory for modification or replacing a serviceable unit just because plant conditions have changed. The unit can be back at work in shortened or lengthened form in a matter of hours rather than the

Industrial trucks, the workhorses of industry, come in all sizes and shapes; will handle a few pounds or a truck-trailer.

weeks it might take to send it in for work at the factory.

Bulk Handling

Progress in bulk materials handling is also rapid. There is considerable engineering effort being expended, particularly in the chemical and food industries, to change to continuous processing. Materials handling is the key to this change. Conveyors handling bulk materials have been developed in many novel designs. There is the "Zipper Conveyor," being offered by Stephens-Adamson, which consists of a flexible tube-like conveyor with a zipper closure along the top. When the zipper is open, the tube may be loaded or unloaded, and when closed, it transports any bulk product in a completely sealed tube.

There is also the tubular conveyor (Hapman-Dutton) in which bulk material can be carried by flights attached to a continuous chain moving through cast iron pipe. This conveyor is excellent for handling metal chips from machining operations, and it can even be used to transport very wet chips flooded with oil. It can be arranged so that the oil and chips are separated in handling, the oil flowing to a reservoir while the chips are moved to a disposal point.

For the handling of many dry, pulverized, and granular materials, air-conveying methods are used very extensively. Some of the obvious advantages are: extreme flexibility, complete dust control, personnel safety, and reduction in labor costs. In the pneumatic field there are several distinct types, such as the high velocity, pressure, or vacuum system (e. g. Airveyor); the moderate pressure type (Fuller-Kinyon) employing relatively high material-to-air ratios with moderate line velocities and air consumption at relatively low pressure, and the high-pressure blow tank type system, which is most generally used for long distance conveying (Fuller-Fluxo).

In addition to the conventional pneumatic conveying methods through pipelines, employing air-material ratios and line velocities required for handling materials of different types, a relatively new and interesting method of handling dry, finely powdered materials has recently been developed, using low-pressure air (usually under 3 psi) to aerate pulverulent materials, causing them to assume a fluid condition in which they flow by gravity at extremely low angles of repose. This principle is used for conveyors, (Airalide by Fuller Company) in which the conveyor comprises a two compartment duct divided by a specially woven cotton fabric diaphragm, through which air is diffused in the material carried on the upper surface of this diaphragm. Another application of this method is for unloading bulk cars especially designed for handling certain types of bulk materials. These are cars designed and leased by General American Transportation Corporation, in which the porous diaphragm is included as part of the container bottom, thus providing means for activating the contents of the car when low-pressure air passes upwardly through the diaphragm, causing the bulk materials to flow by gravity to one or more openings in the car, from which subsequent conveyor equipment transports the bulk material to its ultimate destination.

This basic idea has been found practical and economical in a number of major industries such as cement, fertilizer, chemical, and flour milling, and its application will no doubt be extended.

Special design employing the substitution of refractory media for the usual canvas diaphragm, permits handling of many materials such as flue dust, Cottrell dust, and fly ash at elevated temperatures.

One other type of conveyor has come to the forefront—the oscillating conveyor. Sales have increased greatly. New development (such as Flexmount, by Link-Belt) permit the purchase of pre-engineered stock assemblies. Many difficult to handle materials such as oily chips and hot castings are now being moved by means of oscillating conveyors.

Automatic Control

Automation is by no means limited to the handling of individual items. Bulk materials handling lends itself excellently to automatic control. A typical example of continu-

ous automatic bulk materials handling as a part of processing is in the mixing of such items as concrete. If a mix is to be one of cement, three of sand, and five of gravel, conveyors from each storage hopper can be controlled to feed exactly that proportion to the mixer.

This blending control is being used with an automatic feed in the textile industry for making very accurate blends of various fibers—cotton and wool, cotton and Nylon, Nylon, Orlon, and wool.

Yard Storage

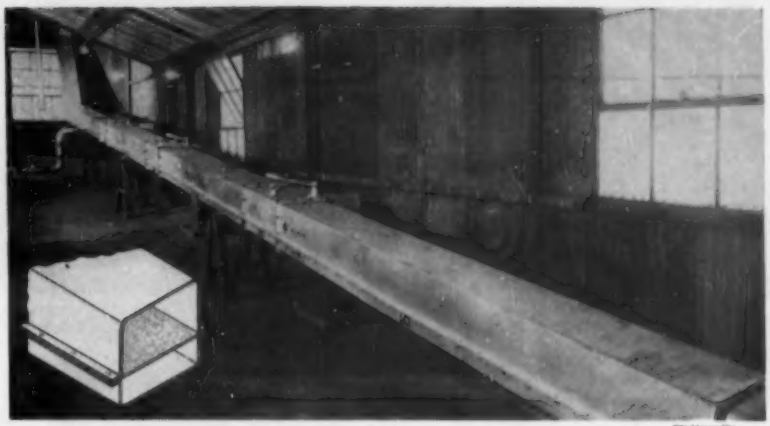
One other notable trend in materials handling is the increased use of yard storage. As factories expand, the premium on inside storage space is increased, and emergency yard storage is gradually becoming regular practice. This has encouraged the development of improved yard cranes and straddle trucks (speeds up to 50 mph, load to 22 tons) as well as industrial trucks designed for rugged outdoor use. An important factor in the yard storage of machinery and other metallic equipment is the danger of corrosion. This can be overcome on iron, steel, and aluminum by coating the equipment with special chemical films which protect it in enclosed packages for very long periods. Mixing Equipment Co. of Rochester has been coating all metal mixing equipment with a spray of a chemical compound known as VPI, manufactured by Shell Oil Co.

Dust Control

The dust nuisance created by the handling of fines and coal has been recognized as part of the materials handling problem. It is being answered in two ways. Manufacturers of materials handling equipment have developed semi-dust-tight designs, while the dust collection manufacturers have come out with a number of special collectors designed to reduce or eliminate the dust problem over conventional coal handling or other dust producing systems.

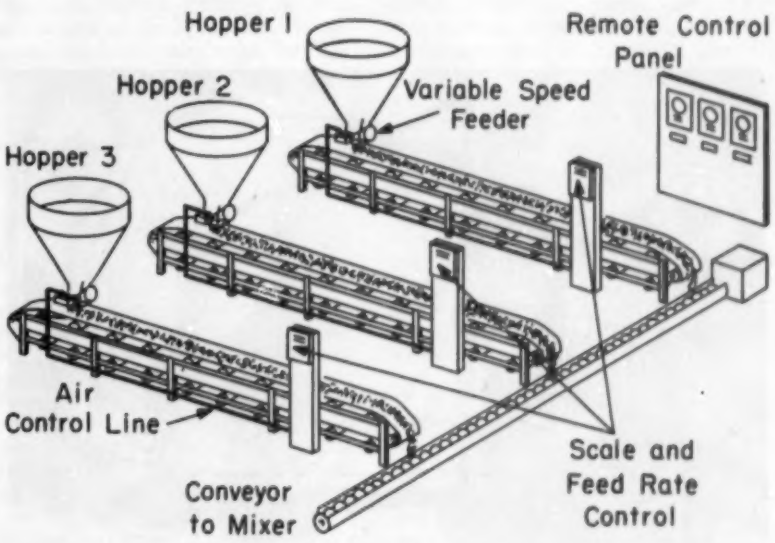
Summary

A look into the future indicates that the process or assembly materials handling system which does nothing but handle may well disappear. The trend is toward the incorporation of the conveyor as a part of the process—or perhaps the process as a part of the conveyor, depending on your point of view. Contrasted with this is the continual development of more rather than less flexibility in handling in the increased use of the universally adaptable industrial truck.



Fuller Co.

Airslide is designed to handle powdery bulk materials. Note cross-section.



Bulk materials can be automatically weighed and blended with remote control.

Rapids-Standard

Gravity conveyors of many types are an integral part of the production line

Water Treatment

I&P Annual Review

Progress in the development of conditioning methods and in the application of treatment systems is keeping pace with the constantly increasing demands for high quality water.

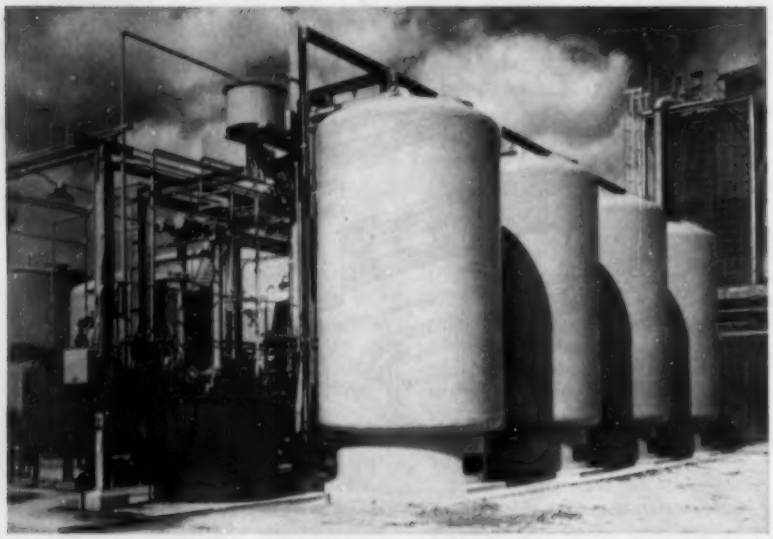
EFFICIENT water utilization is one of the most urgent problems currently facing industrial plants and utility generating stations. Water is required for: boiler feed, processing, cooling, drinking, sanitary facilities, fire protection, and various other services. While these demands are constantly increasing, reports indicate U. S. water supplies in many places are becoming depleted. Frequently, reuse of the available reserves is imperative. This situation has fostered a trend toward the use of more complete water conditioning systems to eliminate the many troublesome physical, mineral, and chemical impurities which interfere with efficient operation of process equipment and steam generators.

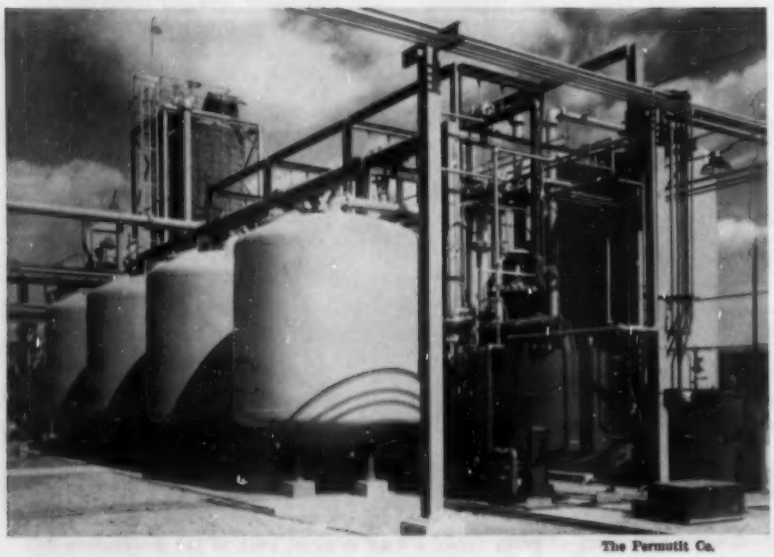
Since treatment varies with both raw water quality and end use, there has been an increase in the use of water treatment consulting service. Many plants now conduct surveys of each water consuming operation and integrate all water treatment procedures into one centralized function completely independent of production. This permits the setting up of separate units for clarifying, softening, demineralizing, or treating the water in any other way that may be required. Even after the system design is established, constant checks by plant personnel and periodic analyses by a qualified consultant are necessary to assure the maintenance of exacting quality control.

Ion Exchangers

The development of ion exchange resins has experienced tremendous strides in the past five years. Ion exchangers are capable of eliminating not only hardness elements from water but objectionable dissolved solids, alkalinity, corrosive elements, CO_2, and silica as well. Cation exchange resins presently available withstand acid and alkali concentration over the entire pH range, temperatures in excess of 250 F, and chlorine and iron content of liquid far in excess of any previously deemed permissible. Operating temperatures with anion exchange resins still are limited to approximately 100 F but continuous improvement is expected.

Most of the conventional designs of ion exchangers used in the past are suitable for present methods without change. Possibly the great-





The Permutit Co.

The Permutit demineralizing and silica removal system shown at left has four cation exchange units with degasifier (top photo) and four anion exchangers.

est advances have been in materials which will withstand the action of temperature, pH, and all the other factors which are no longer a problem with resins. Since the end of the war new alloys, protective coatings, and linings for tanks, piping, and valves have been introduced. Even greater emphasis will be placed on construction materials as further progress creates more severe operating conditions.

Precipitation Type Units

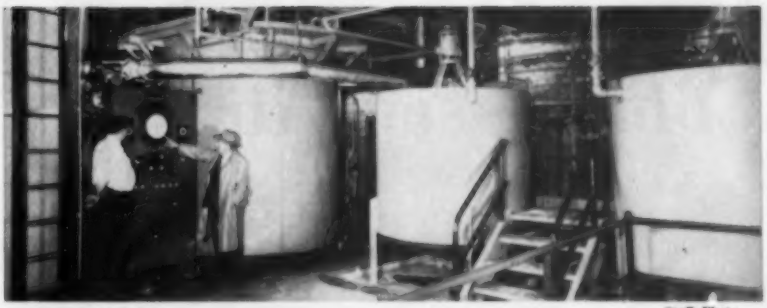
Among water conditioning units of the precipitation or reactor type, hot process lime-soda and cold process softeners remain basically unchanged. The suspended solids contact (sludge blanket) design was introduced some years ago, but very little of anything new has been experienced since or is anticipated in the immediate future. Currently, rapid rate pretreatment units of this type are widely used for clarification, alkalinity reduction, and hardness removal at normal temperatures before the water is treated by ion exchange or hot process methods.

In hot process softening, the trend is away from the second stage hot phosphate following the initial hot process lime-soda treatment. Modern practice favors utilization of an initial stage using only hot lime followed by a second sodium ion exchange stage at elevated temperatures to remove residual hardness. This is the now well publicized and accepted hot process-hot zeolite system which was developed within the last few years. Units of this type are available in capacities up to 200,000 gph.

The one field that will bear watching, but which on the basis of present industry knowledge is some 5 to 10 years away from being practical for general use, is removal of ions by means of resinous membranes. Information on this method is beginning to come to light, and some pilot units are in operation. The expected field of use for this type of equipment is the handling of very highly mineralized waters for reducing dissolved solids content to acceptable limits rather than for complete demineralization.

Steam Generating Plants

One major factor which has had a marked effect on water treatment is the trend toward the use of higher pressures and temperatures in steam generating plants. Such installations cannot tolerate water impurities and exacting control must be maintained. It is, therefore, interesting to note that there has been increased acceptance of properly designed and engineered ion exchangers for demineralizing and removing silica from feedwater for high pressures boilers (1250 psig and up) in lieu of the evaporators heretofore generally employed for this purpose. This trend has developed because ion exchangers are capable of consistently producing a water of higher quality than evaporators, and for most waters the economics (all factors considered) favor the demineralizing plant.



Staff Photo

Photo shows an automatically operated Cochrane hot process softening system.

In the future it is expected that demineralizers will find wider acceptance for "scavenging" condensate supplied to boilers operated at 2500 psig and up. As this trend develops, it is expected that there will be greater and greater emphasis on the need for pretreating equipment which will supply high quality feed at the demineralizer inlet so that maximum exchanger capabilities can be fully realized.

Many engineers believe that the smaller industrial plants will make increased use of the principles tested in utility stations. It is expected the number of hot process-hot zeolite installations will increase, with practically all of them using the new higher capacity materials. One additional trend may be toward increased "dealkalization" of boiler feedwater by the direct anion exchange of alkalinity for chloride anion method of treatment.

There also will be increased attention focused on preventing corrosion in condensate return and boiler feed systems. This will include: proper choice of pretreatment, deaeration of makeup and condensate returns, use of catalyzed sodium sulfite or hydrazines, use of filming materials for condensate treatment, and use of volatile amines which have been recently developed in formulas that are stable at the highest boiler operating pressures now employed. It is interesting to note that while deaerators capable of handling upwards of one-million lb of feedwater per hr are commonplace, a more complete awareness of the possibility of control of corrosion in a steam-water cycle by this method is increasing deaerator utilization, even in the small plant.

Much greater attention will be given to cooling water treatment. One trend which will bear watching in this regard is the use of vacuum deaerators for removing corrosive gases from water circulated through cooling systems. The economics of this method seem to be the only stumbling block toward wider acceptance although ever increasing labor and material costs for maintenance may make use of such devices more practical.

Automatic Operation

Possibly the most definite tendency of all during 1953 has been the leaning of industries, institutions, municipalities, and central stations toward fully automatic or semiautomatic (push button automatic) electrically, hydraulically, or pneumatically operated water treating equipment. Automatic or semiautomatic operation prevents human errors, frees operators to perform other duties, and eliminates the need for highly skilled or technically trained personnel. Controlled chemical feeding for plants utilizing secondary treatment systems is also expanding with many of these arrangements using proportioning pumps.

In summary, it appears that the most definite trends are toward: greater use of hot process-hot zeolite softening; expanded use of sludge blanket design hot and cold precipitators; replacement of evaporators by demineralizers for preparing makeup for high pressure boilers; more careful control of corrosion in condensate return lines through CO_2 removal and the use of vastly improved amines; and greatly increased use of fully and semiautomatic systems.

Compressors and Compressed Air

I&P Annual Review

Centrifugal and axial type compressors are finding many new applications, particularly where large volumes and moderate pressures are required.

COMPRESSED AIR is a plant facility second in importance only to power and water as a necessary part of modern industrial operations. When air compressors are combined with gas and refrigerant units, they represent plant equipment equalled in magnitude only by a few types of industrial machines.

The stationary, reciprocating compressor is certainly not a newcomer to the industrial field. The compressors in many plants are older than the engineers who operate them. However, every month sees new models from compressor manufacturers. Although primarily refinements of well established basic designs, these new models are of considerable importance to plant engineers. New types of drives, cleaner design, better auxiliaries, higher efficiencies, and design improvements which simplify maintenance are all of vital interest to industry.

The use of aluminum and other light metal castings and aluminum-steel bonded pistons have made possible the manufacture of lighter units requiring simpler and less expensive foundations—once a major problem with heavy, vibrating compressors.

Dynamic Compressors

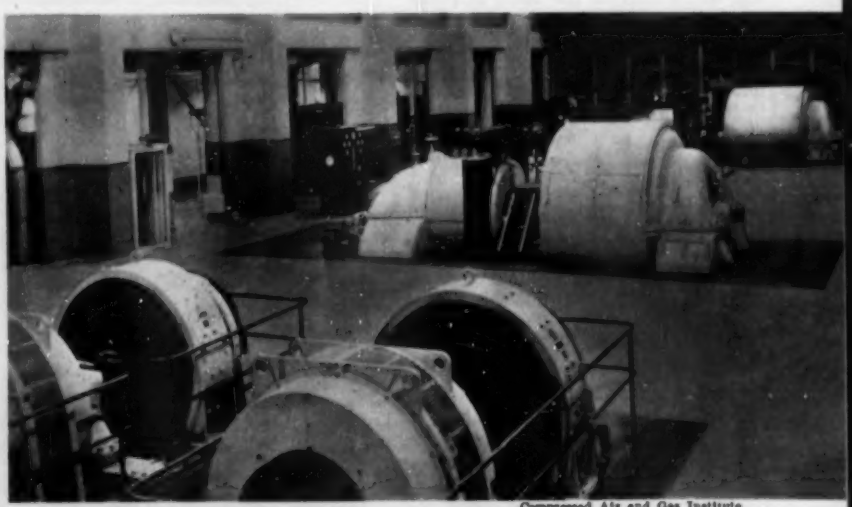
Axial and centrifugal blowers or compressors (dynamic-type) have received the most attention from designers in recent years. The axial compressor is used in conjunction with the gas turbine. Consequently, the development of both the aircraft and the stationary gas turbine gave enormous impetus to axial compressor design and construction.

Axial and centrifugal blowers and compressors are inherently high-speed machines and would appear to be most suited, at their current stage of development, to applications requiring large capacities and moderate pressures. Commercial single-stage centrifugal blowers for handling air are available in capacities from about 500 to 100,000 inlet cfm or more, with pressures ranging from 1 psig for small capacities to over 7 psig. For special applications, capacities have been extended to 300,000 inlet cfm by using double inlet construction. Single-stage axial blowers are available in capacities of 5,000 to 100,000 inlet cfm with pressures from 1 to 3 psig.

Commercial multistage centrifugal blowers and compressors for handling air are available in capacities from about 500 to 150,000 inlet cfm, with pressures ranging from 1 psig for small capacities to 300 psig or more for medium and large capacities. Multistage axial blowers and compressors have thus far been limited to special applications with at least one machine capable of handling about 2,000,000 inlet cfm. The range of available pressures parallels that of centrifugal units, the attainable pressure being a function of capacity and the characteristics of the gas to be handled.

The primary difference between axial and centrifugal machines with respect to operating characteristics lies in the fact that centrifugal units will deliver practically constant pressure over a wide capacity range, while axial machines deliver constant capacity at variable pressures.

Centrifugal compressors have long been used in steel mills for blowing blast furnaces, bessemer converters, and for coke oven exhausters and boosters. More recently, the manufactured gas industry has become a major user of centrifugal compressors for gas blowers, exhausters, and distribution system boosters. In recent years the big new application has been in the petroleum and natural gas industries. (See Centrifugal Pipeline Compressors, I&P, August, 1953). The chemical industry also has become a major user of this type of compressor. In addition, installed capacity has increased rapidly in applications using centrifugal units as exhausters for continuous rotary filters, scavengers for diesel engines, blowers for pneumatic conveyors, forced draft for pressurized



Compressed Air and Gas Institute

Centrifugal compressors, such as the two huge turbine-driven multi-stage blowers shown in this view, have long been used for blowing blast furnaces.

boilers, and for circulation of steam for recompression evaporators.

Although axial compressor application has been limited primarily to the gas turbine field, single-stage units are finding wide application in ventilating work and as forced draft units for boilers.

Free Piston Compressors

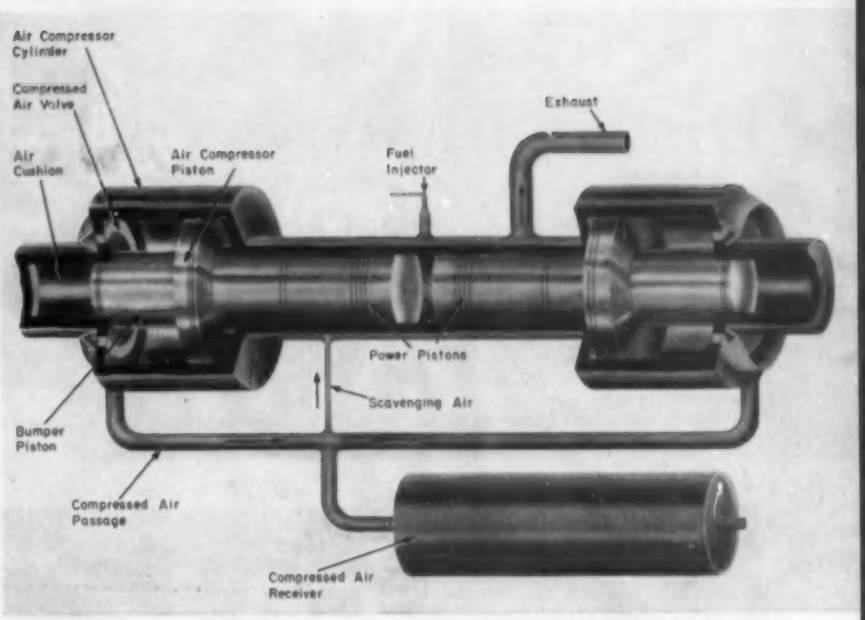
If we in this country have seen a trend toward the extended use of dynamic-type compressors, an equally important trend has come to light in Europe in the development of a highly efficient reciprocating compressor of "free-piston" design. This compressor is based on old patents, but it has been only since the war that any have been built for commercial use. Basically, the design makes use of an opposed-piston diesel cylinder, the outward end of each power piston extending into a larger piston which moves within a compressor cylinder. Air, compressed in each power stroke, is discharged into a compressed air receiver.

Since free piston compressors operate without conventional crankshaft and bearings, and compress air directly with each power stroke of the diesel power cylinder, they are extremely efficient — as efficient as the modern diesel.

The Navy found compressors of the free piston design, built by Junkers, on German submarines captured during the war. Shortly after the war, every large air compressor manufacturer in the United States was invited to participate in the free piston air compressor program by the Bureau of Ships. According to Commander J. J. McMullen, several of the manufacturers under Navy contracts built "Chinese copies" of the Junkers air compressor. However, the manufacturers declined to pursue development of the free piston compressor for commercial purposes. McMullen says that the lack of commercial exploitation by American manufacturers has been due to their own desires and may have been caused by reluctance to take on a new line differing so widely from their present lines.

SIGMA, in France, has built many of these compressors and has licensed manufacturers in England and other countries. General Motors recently signed an agreement with SIGMA for the development of their free piston compressor, and it is thought that they intend to use it as a supercharger for diesel engines, as well as for other applications.

Unlike the axial and centrifugal compressors, the free piston compressor can be a very high pressure machine and could do any job now being done by conventional positive displacement machines. While understandable, it is regrettable that American compressor manufacturers have so long ignored this promising design. However, with General Motors in the field, others will no doubt soon follow.



In the free piston compressor, two opposing pistons operate on the diesel cycle. Each connects with a larger piston within the compressor cylinder.

Auxiliary Equipment

For many years the problem of moisture in compressed air has plagued the plant engineer. Inter- and after-coolers have been added to compressors to reduce moisture content of the delivered air. Recently, there has been a trend toward the use of refrigeration and chemical dryers to rid the air of moisture.

Chemical dryers, commonly known as dessicants, may be either adsorbent or absorbent substances. Commercial adsorbents are usually activated alumina, calcium chloride, silica gel, activated bauxites, and calcium oxides, while the absorbents in general use are lithium bromide, lithium chloride, ethylene glycols, and calcium chloride brine.

When the chemicals become saturated, it is necessary to reactivate them by using heat to drive off the entrained moisture. Solid desiccant systems are usually designed in multi-unit arrangements to permit half of the units to be used while the remainder are being reactivated. Liquid systems can be arranged for continuous or intermittent withdrawal for reactivation. The reactivation of liquid desiccants is accomplished by boiling off the water—the boiling point of water being lower than that of the chemical used.

The effectiveness of commercial filtering systems is essential to the success of chemical drying, since such impurities as dirt and oil act to contaminate the desiccants and reduce their effectiveness. Also there is a certain amount of carry-over with both adsorbent and absorbent substances which causes undesirable reactions in some instances. With all chemical drying systems, the problem of maintaining a predetermined moisture content of the departing air or gas involves the use of a major, complicated, and usually expensive control system.

Mechanical refrigeration offers a simple and dependable way to obtain any degree of dehumidification. Essentially, it involves the use of an additional after-cooler to further reduce the temperature of the air.

The best advantages of both systems can be gained by combining refrigerant and desiccant systems. Most of the moisture and oil vapor can be removed by refrigeration. The remaining amount of moisture, above that of design conditions, can then be processed by the desiccant system. The principal advantages are that reactivation of the desiccant is held to a minimum, and the cool, clean, relatively dry air assures maximum dehydration efficiency of the desiccant. Also, adsorption capacity of granular desiccants increases at lower temperature.

Electrical Distribution

I&P Annual Review

Distribution system up-voltaging is stopping at 480-volt level. No preference is developing for any one configuration of electrical system layout.

BRINGING ELECTRIC POWER to the utilization device has become more than a matter of replacing mechanical shafts with electric wire. Not long after the forests of flat belts and line shafting began fading from the industrial scene, new problems of safety, reliability, and efficiency arose.

Voltage

The days when power and lighting were thought of in the same terms are gone. It also soon became apparent that large amounts of power for "point" machine locations presented problems different from lesser amounts of power stretched out over large "areas" for lighting. Blocks of power for machines are more efficiently transmitted at voltages too high for ratings permitted in lighting circuits.

There are those who presently advocate hanging lighting load off of plant power circuits through step-down transformers to avoid duplicate wiring. But the distinction between the systems is still maintained in the matter of relative voltage levels.

The uniform trend has been to think of raising voltage levels for power circuits. Currently, 240 volts is largely out of the picture for new or re-wired circuits. Voltage levels as high as 600 volts are being talked about but the limited availability of utilization devices for this voltage is discouraging such thinking. Most common recent practice settles on 480 volts.

Load center unit substations are most favored for industrial systems. Regardless of the type of distribution system, power is carried as far as is practical at primary voltages from 2400 to 15,000 volts. Outdoor substations are recommended to bring the voltage entering buildings down to the 15 kv maximum.

Considering 20,000 kva load as about a breakeven point, 4160 volts is favored for primary systems of smaller capacity and 13.8 kv is favored for systems over 20,000 kva. (This criterion is not universally held, however.) Some practice favors using 13.8 kv for loads as small as 10,000 kva where future load growth is imminent. Many unit substations are being put on roofs or on overhead galleries to conserve floor space and to shorten secondary runs.

Distribution

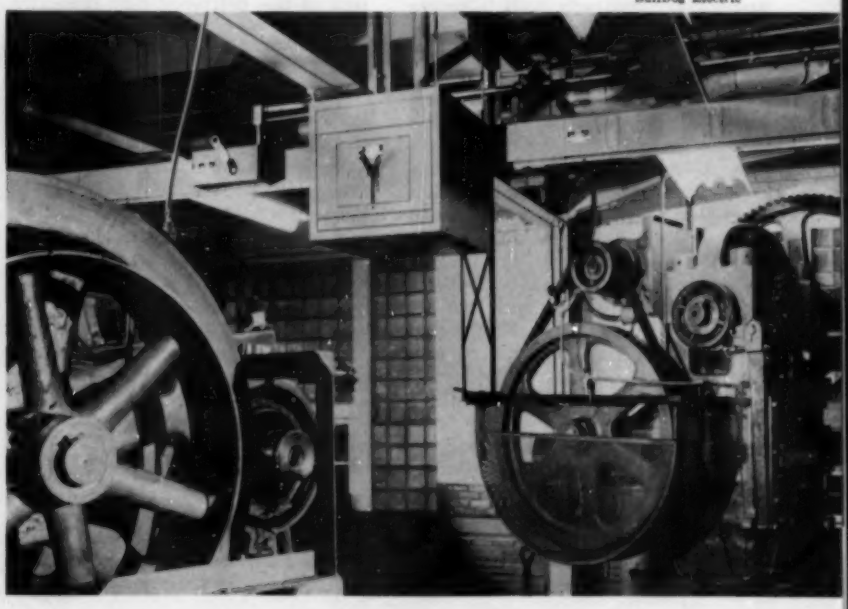
There is no clearcut trend toward any species of radial or secondary network system. Each of the many variations has its place and represents compromises with cost, efficiency, regulation, and reliability. The choices among compromises remain varied. The same holds true for primary systems.

Modernization programs are responsible for many piggy-back arrangements where high-voltage primary grids are superimposed on existing secondaries. Tie-ins between primary and secondary systems are made through unit substations

Westinghouse

More flexibility for bus duct installations is promised by telescopic plug-in section (above).

BullDog Electric



Adaptability of bus duct helps keep plants electrically modern despite layout changes (right).

placed around the plants. The new connections require relatively minor hook-up changes, permitting fullest utilization of the existing secondary system. Dry-type transformers are also finding increasing in-plant application for stepping primary voltages down to utilization levels, especially for lighting.

Wiring and Bus

Some great concern is being expressed for the prevalence of inadequate wiring, particularly in smaller industrial plants. This only points up the increasing interest in wiring systems. Bus duct, including aluminum bus, is finding much favor in its Erector-set type of simplicity. Its adaptability is in keeping with today's trend toward design with flexibility for future change in mind. Metallic and asbestos-base conduit are not being pushed aside by enclosed bus in any manner of speaking. The significant trend is the inclination to place more protection around plant wiring.

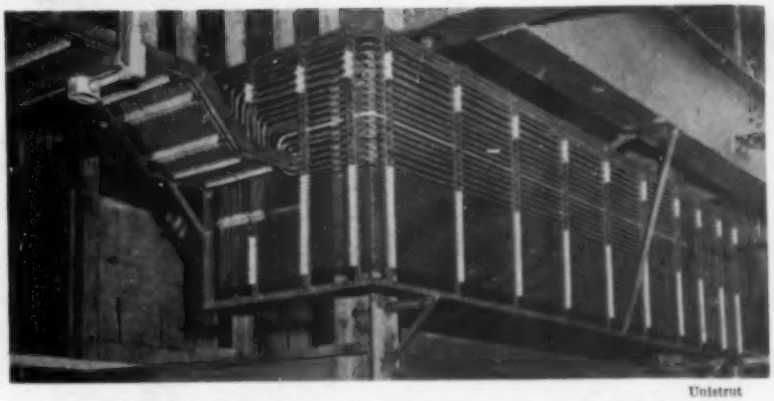
Regulation

The matters of regulation and power factor are of varying concern. Effects of undervoltage and overvoltage have long been acknowledged. With the increasing use of electronic devices, concern over regulation is even greater; 5 percent overvoltage cuts tube life 50 percent.

Some industrial plants are faced with penalties when their power factor drops down to a mere 0.95. The distribution system in this kind of situation will reflect a concern with power factor correction in keeping with this kind of stringent imposition.

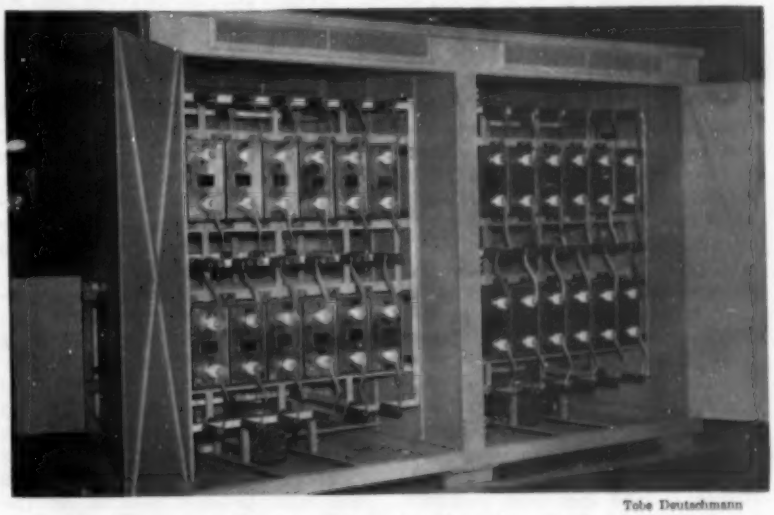
Power factor correction at the load is gaining some favor. Application of capacitors at offending devices eliminates the loss effects of poor power factor before they can exist even on the secondary lines. Factory-assembled capacitor stacks are becoming industry standard. Capacitors are being made available in types suitable for use in metal-clad cubicles for protection against tampering, in special dust-tight units, and in units of greater capacity for network vault locations susceptible to flooding; automatic capacitor-switching is gaining acceptance.

In the final analysis, current thinking appears to give more and more emphasis to other considerations beside first cost. Adaptability to changing load conditions, service continuity, regulation, efficiency, and operation-maintenance costs all influence the choices being made in selecting new systems and in modernizing.



Unistrut

Moss Landing Station uses conduit on racks to carry electrical power.



Tobe Deutschmann

Packaged power factor correction capacitors for atomic energy plant.

General Electric

This 13.8-kv, 480-v unit sub is going into a plant now being completed.

Pumps

I&P Annual Review

Higher pressures and temperatures as well as an increase in handling of corrosive liquids have resulted in improved designs and special constructions.

THE CENTRIFUGAL PUMP, which represents about 60 percent of the pumping field, has constantly undergone developments which have made it more efficient, more reliable, more adaptable to a constantly growing series of services.

Because of the wide variety of services for which centrifugal pumps are intended, it is best to examine trends separately for the different types of services.

Boiler Feed Pumps

Operating pressures and temperatures for boiler feed pumps are still rising. Throttle pressures went from 1250 psi to 1450, then 1850, then 2400 psi. An order has been placed in 1953 for the first turbine to be operated above the critical pressure of steam. The throttle pressure will be 4500 psi, requiring boiler feed pumps with 5500 psi discharge pressure. While this unit must be considered strictly as an experimental installation, there is no doubt that other installations will follow.

This trend to higher pressures is heightening the interest in operating speeds higher than 3600 rpm. Worthington Corporation has built a 9000 rpm, four-stage boiler feed pump designed for 2721 psig discharge pressure, driven by an electric motor through a step-up gear. It is probable that a number of gear driven installations will be ordered in 1954-55.

Another important trend in steam power plant construction has been the growth of turbine sizes. There are 200,000 kw units being built, and even larger units are contemplated. Even assuming that the practice of installing two half-capacity pumps per unit and one standby is continued, this trend will lead to boiler feed pumps of 2000 to 2500 gpm capacity and even larger. Coupled to the growth in discharge pressures, boiler feed pump power requirements have grown to a point where 3000 and 4000 hp drivers are no longer rare exceptions.

The size of the drivers is reaching a range where serious consideration will have to be given to the advantages of utilizing steam turbine drives. It is, of course, doubtful that these steam turbines would take steam directly from the boiler drum, since the high pressures and temperatures encountered would make the practice prohibitive. The turbines will be supplied with steam either from a bleed stage of the main turbine or from the reheat line.

The battle between the proponents of variable speed operation with hydraulic couplings and advocates of the simpler, constant speed motor drive still rages. The choice is an extremely difficult one to make. No very marked change was apparent in 1953, with about one-third of the installations for 1250 psi throttle pressure and above going to hydraulic coupling drive. For lower pressures, constant speed drives are still the rule.

A growing trend towards closed feedwater cycles is becoming apparent. The deaeration is accomplished in the condenser hotwell, and the condensate pumps or booster pumps discharge into the boiler feed pump suction through closed heaters.

The practice in the selection of boiler feed pump materials has not changed. Cast iron castings with bronze fittings are still limited to temperatures up to 250 F, pH conditions of 7 to 8.5, pressures up to 1000 psig, and only where active corrosion has not been experienced in the past. Where active corrosion has not been experienced, but where the other limitations are exceeded, cast iron castings with stainless steel fittings are used. Finally, wherever active corrosion may be expected and in the higher pressure ranges, the boiler feed pumps are uniformly built with chrome steel casings and stainless fittings. However, a constantly greater number of customers are specifying chrome casings and stainless trim even in the range where operating conditions do not necessarily call for such materials.

In recent years, there has been a noticeable trend among several of the prominent horizontal, split case, boiler feed manufacturers to the use of corrosion resistant steel for the pump shaft. This has permitted the use of the "split ring" method of mounting pump impellers on the shaft without the use of spacer sleeves between adjacent impellers. The corrosion resistant steel of the shaft permits the exposure of the shaft to feed water and the elimination of spacer sleeves has removed the greatest single cause of shaft bending, created by changes in feed water temperature which set up unequal expansion between the shaft and the impeller hubs and spacer sleeves in which the shaft was encased.

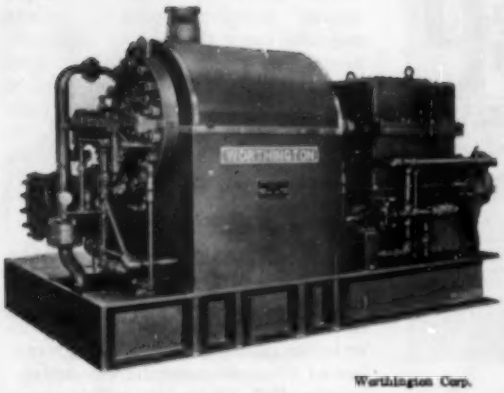
Stuffing Boxes

There is one extremely interesting development in the high pressure boiler feed pump stuffing box construction which is undergoing field tests at the present time. It involves the elimination of stuffing box packing, based on the injection of cold condensate ahead of serrated labyrinth bushings. The leakage past these bushings is recovered and returned to the condenser. The field tests indicate that this construction will be successful and may make a milestone in feed pump history.

Standard Lines

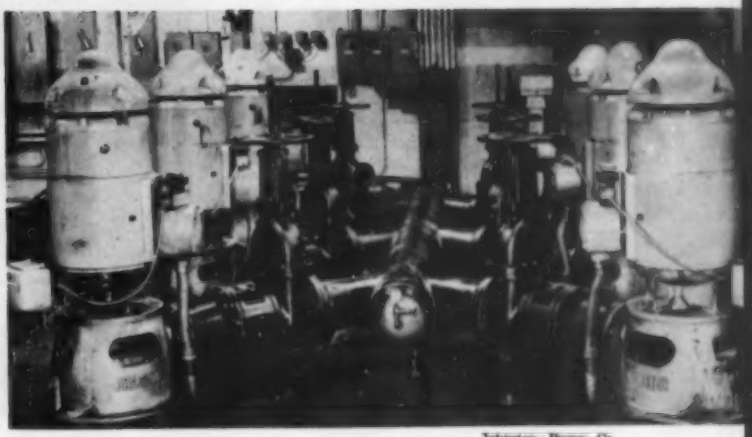
One interesting trend in the small and medium size centrifugal pump field has been an extensive standardization of so-called "production" lines. This trend is prompted by the fact that about 60 percent of all pumps used in industry are centrifugal pumps and over 70 percent of all centrifugal pumps are in the range of heads and capacities which can be met by a line of standardized end-suction pumps.

A typical example of this trend to standardization is the Worthington



Worthington Corp.

Experimental, 4-stage, 9000 rpm boiler feed pump designed for 1380 gpm, 400 F, and a 6550 ft head.



Johnston Pump Co.

Six vertical turbine pumps connected through valves with a single header, are used for pumping cutting oil in an automobile plant.

SESC line of centrifugal pumps. The basic design of this interchangeable line consists of a number of liquid ends, all suitable for mounting on a motor for close-coupled construction, on a bearing frame for coupled or belt drive, or on a close-coupled turbine. A large number of standard modifications are incorporated in the basic plan—both from the point of view of materials selection and mechanical construction—so that "special" units are eliminated. The extensive range of conditions which can be met with this line is apparent from the fact that driver sizes range from ¼ hp to 60 hp at speeds from 900 to 3600 rpm.

Volute Construction

Volute case construction, according to De Laval Steam Turbine Company is surplanting diffuser vane pumps for reasons of maintenance, ease of disassembly, efficiency, and the fact that with this design, it is easier to obtain the desired "rise" of the head capacity characteristic curve. Radial balance for the volute type construction is being obtained by the practice of staggering the volute tongues. The beginning of the volute scroll for the various stages are placed 180° apart to compensate for side thrusts which may be created at off-peak operation.

A trend can be seen in the elimination of water jacketing at the bearing housings. In place of this older cooling arrangement, many manufacturers are now furnishing coolers in the form of coils and finned tubes which are inserted into the bearing housing and come into direct contact with the bearing lube oil. This change is of particular interest to operators which have a condition where the cooling water has a tendency to form a crust or scale on heat exchange surfaces. The new insert type of oil coolers are easily cleaned or can be completely replaced in minutes.

Vertical Turbine Pumps

Minimum space, flexibility, elimination of priming, and steep head-capacity characteristics are a few of the factors influencing the increasing usage of vertical turbine pumps.

For drainage and dewatering; for cooling tower and booster service; for circulation or condenser pumping; for handling water, volatile fluids, and certain chemicals, there would seem to be a trend toward use of the vertical turbine pump.

The trend toward the vertical type pump is accelerated further by other new features. Johnston Pump Co. has developed, for industrial wet pit applications, a new close-coupled vertical turbine pump that eliminates packing glands. This pump is a pre-engineered, packaged line from which a unit can be selected to meet existing conditions.

Chemical Pumps

There is an evident increase in the number of inert materials such as carbon (Karbate, of Union Carbide & Carbon) or Haveg (asbestos fiber and plastic) used for pump construction. These materials are being used for very corrosive chemicals which lie outside the ordinary province of stainless steels.

A continuing and enlarging interest is apparent in the use of coatings—either thin coatings, such as baked-on formaldehydes, or thicker coatings, such as vinyl plastics, resins, or neoprenes. Small pumps are being manufactured with plastic casings and impellers and glass shafts for extremely corrosive liquids. An increasing interest is evidenced in the use of mechanical seals. These are being requested for more and more difficult services, as field experience indicates that their application range may be extended.

Controlled Volume Pumps

During the past fifteen years, controlled volume pumps have gradually replaced the early adaptations of forced feed lubricators and are now being increasingly used as final elements in process control. The scarcity of literature on this relatively new process control equipment is perhaps responsible for the limited association between low capacity flow control problems and this obvious solution. Another contributing factor stems from the early use of these pumps only for water treatment systems. As a result, many engineers still regard controlled volume pumps as strictly for this service.

Controlled volume pump manufacturers, such as Milton Roy Company, are now working closely with industrial users to solve the problems inherent in handling corrosive fluids at high pressures. At least two new designs have resulted from industry's demand for such controlled volume pumps.

Specialized Field

Spurred on by various special requirements introduced by man's unlocking of atomic energy, the pump industry has had to develop entirely new equipment.

It is not permissible at this time to describe the advances made by the industry in this specialized field, but much of the knowledge obtained will serve to improve construction of pumping equipment intended for conventional industrial services.

Power Transmission

I&P Annual Review

Power transmission devices are keeping step with new developments in drives as well as changing characteristics and demands of the load. Users are finding broader applications for pre-engineered designs.

THE "BREAD AND BUTTER" of power transmission devices in industry are the V-belts, chain drives, gears, speed-reducers, clutches, torque converters, and mechanical and hydraulic couplings. Although each manufacturer is continually developing his own product and attempting to expand its usage, to date and in the foreseeable future, each device finds a specific field of application in which its advantages stand out. There seems to be a place for each, and the ultimate choice depends upon the application.

While basic changes are not forecast for the "bread and butter" side of the transmission devices, trends that aim towards compactness of units, minimum vibration and noise, self-lubrication, sealed and semi-sealed bearings, will continue.

New Concept

There is a new concept that is rapidly being accepted by the manufacturers. That concept stresses a wide range of selectivity, availability (from industrial distributors), and a minimum of engineered installation work by the user. For lack of a better word, these can be called "pre-engineered products."

The move towards "pre-engineered" power transmission devices requires more than twice the engineering time and effort on the part of the manufacturer. However, it substantially reduces application effort on the part of the user to fit, install, and adjust the product on his own machinery.

"Pre-Engineered" Sprockets

One of the best examples of the application of the concept of "pre-engineered" products is the adoption of the "taper-lock" bushings in roller chain sprockets by a number of chain transmission manufacturers. This gives the roller chain drives the benefits of flexibility in fitting already enjoyed by V-belt drives, pulleys, and couplings; by making sprockets available immediately from stock to fit all normal shaft diameters without expensive and time consuming reboring operations. The long term indications are that the taper-fitted bushings will be extended to larger sizes and to other types of sprockets . . . perhaps even to gearing.

Future

The application and future development of power transmission devices—high speed chains and gears, hydraulic clutches, torque converters, hysteresis clutches—will depend basically upon the evolving characteristics of the load and of the prime mover.

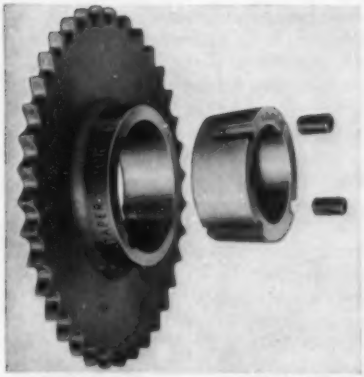
In the field of prime movers, the tendency has been and continues to be toward larger units with higher speeds. For instance, twenty years ago an 800 rpm diesel was considered high-speed; ten years ago 1200 rpm was high speed; and today that figure is around 1800 to 2100 rpm with all signs pointing toward further increases.

The advent and broad application of the gas turbine in the utility, transportation, pumping, and other fields, means shaft speed from 5000 to 15,000 rpm with horsepowers in the range of 5000-6000.

Coming Devices

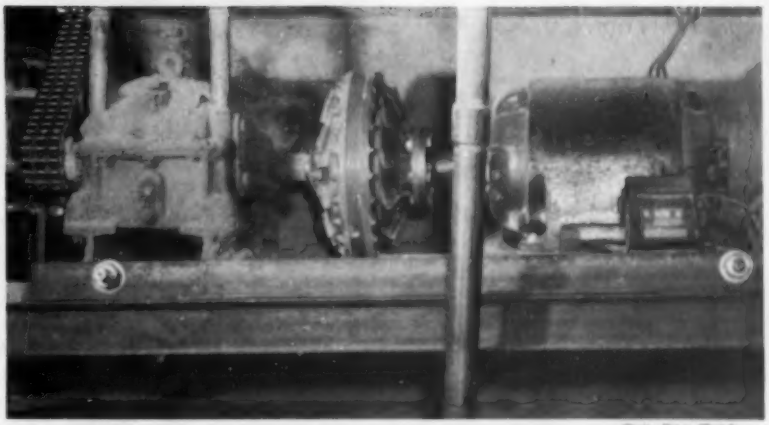
In terms of power transmission, it means the growing use of hydraulic couplings, torque converters, high speed chains, and gears. For these,

A hydraulic sheave drive helps to eliminate slippage and delayed action on the reversing aprons in a large Southern textile mill.



Dodge Mfg.

An exploded view of a "taper-lock" sprocket. Available from stock, they are designed so as to fit all standard shafts without need for reboring.



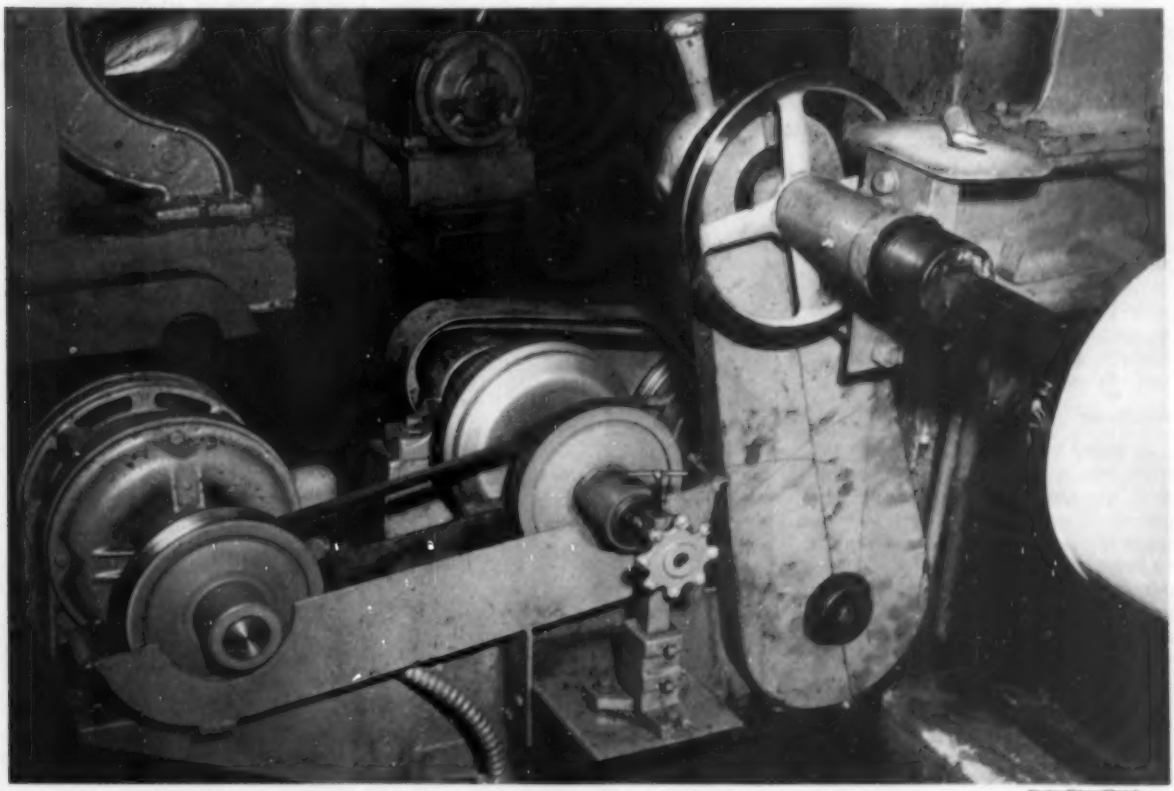
Twin Disc Clutch

By cushioning the load and permitting smooth stops and easy starts, hydraulic coupling reduces motor troubles on a tramp iron detector drive.

metals will have to be specified to transmit the required power; coolants and cooling systems to carry away the generated heat; bearings to support the loads, withstand heat, and minimize friction. And while at the present time there is no standard commercial clutch on the market that will transmit the higher speeds and horsepowers of the gas turbine, as the demand for turbine units increases, the engineer-designer will no doubt successfully resolve these and other problems.

Load Characteristics

Load characteristics continue to be influenced by industry's emphasis on automatic operations. Faster operations, minimum maintenance, elimination of human fatigue and human error, incorporated safety features, flexibility, and improved efficiency are considerations that will be weighed in choosing and developing the type of power transmission for a given application.



Twin Disc Clutch

A hydraulic coupling is combined with a speed reducer on an embossing padder to provide absolutely even roll tension.

Lubrication

I&P Annual Review

High maintenance and replacement costs of equipment have encouraged development of improved lubricants and lubrication methods.

FOR MANY YEARS lubricant manufacturers and users alike have been seeking a multipurpose grease—one lubricant which would satisfy all grease lubricating requirements. If such a product could be developed, it would serve to reduce inventory and eliminate application errors. The ideal lubricant also would improve operating efficiencies and, through superior operating qualities, would reduce total quantities of grease consumed.

Present day lubricating greases consist chiefly of petroleum oils converted to a greaselike consistency with a thickening agent, often a soap, thus forming a spongy structure which holds oil in a mesh of soap fibers. Such metallic soaps as sodium, lithium, barium, calcium, and aluminum are in common use. Lithium soap greases are becoming increasingly popular wherever resistance to temperature extremes or moisture is required. However, despite the many recent developments, no one soap-based grease is able to withstand all temperature, pressure, and corrosion conditions.

Additives

A trend toward higher speeds for such equipment as motors, paper mill machinery, rolling mills, and gas turbines is continuously creating a necessity for special lubricants to meet extreme conditions of temperature and pressure. Among those being used are silicone greases, powdered and colloidal graphite, molybdenum-disulfide powder additives, and oils modified in other ways. Because of either cost or limited characteristics, however, none of the materials now available is suitable for widespread use.

Perhaps the most promising developments for some special applications are in the field of solid-type thickeners. Bentonite and silica aerogel are two of the thickening agents on the market today. Other forms of silica also give promise. Unfortunately, they are expensive and have been used thus far only where top performance is a necessity. One solid thickening agent, now in the development stage, is a new type of fuller's earth. It is expected to be on the market soon, and it promises to be cheap and sturdy enough to replace many special purpose products now in use.

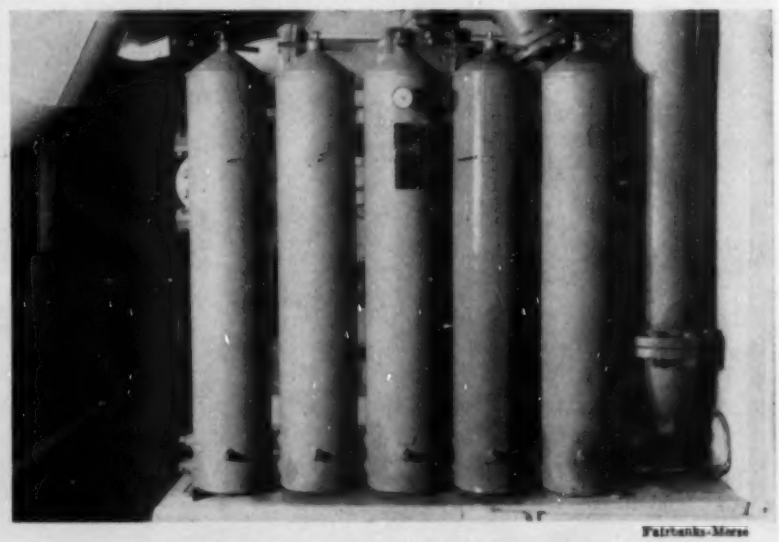
Bearing manufacturers, as well as lubrication engineers, are encountering problems as a result of higher speeds and loads. Pressure-lubricated bearings will no doubt be used to meet many extreme temperature and pressure applications. Lithium greases with extreme pressure additives have been developed for high-load applications.

Looking further into the future, as even greater extreme conditions are encountered, the ultimate solution may be the use of air as a lubricant. Air can be used to center a shaft within the sleeve so as to prevent friction surfaces from coming into contact. In addition to eliminating fluid lubricants which tend to break down at extreme conditions, such a method would be completely clean and the air leakage would carry away heat. Research laboratories have devoted considerable effort toward development of this method to reduce the enormous power required for starting such equipment as steel mill rolls. Metal-to-metal contact could be eliminated if the rolls were "floated" on air. Air lubrication also is being investigated for lighter loads such as machine tool spindles.

Lubricant Application

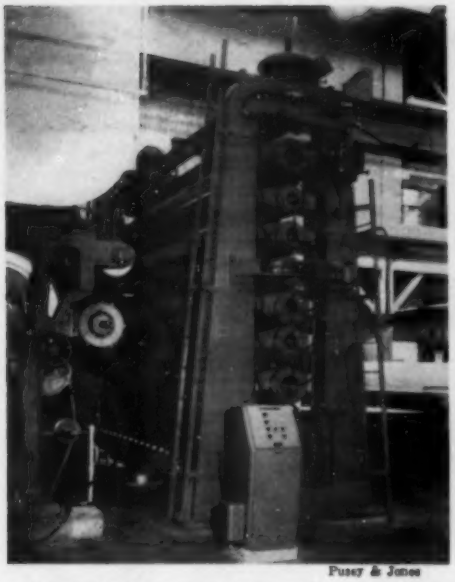
Lubrication engineers have not confined their efforts to problems of extreme temperature and extreme pressure only. Many of the problems they encounter have no relation to extreme conditions. Failures can result from lack of adequate lubrication, over-lubrication of anti-friction bearings, abrasive and corrosive contaminants in the lubricant, and errors resulting in the application of the wrong lubricant.

Many plants are overcoming these difficulties by using centralized lu-



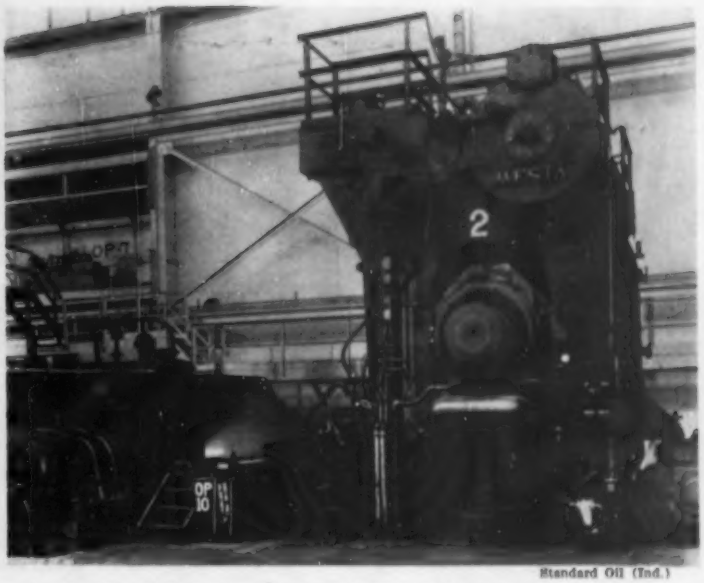
Fairbanks-Morse

Diesel lubricating oil from four engines, totalling 6300 hp, is continuously passed through this 10-cartridge cellulose-type filter at Beloit, Kansas.



Pusey & Jones

Automatic lubrication is used for the bearings of this calender stack in a paper mill.



Standard Oil (Ind.)

Centralized lubrication systems eliminate difficult manual lubricating operations on such equipment as the steel mill roll shown in this view.

brication systems. Centralized systems range from manually operated pumping types to fully automatic, power-operated, time-clock controlled arrangements. These systems provide a means for controlling the quantity of lubricant used and the time interval between lubricant injections. In addition, they eliminate the necessity for shutting down machines for lubrication—an important consideration in modern "automation" production methods. Another important factor in favor of widespread use of automatic systems is the fact that the initial cost of the equipment usually can be justified by savings in labor costs and by noticeable lengthening of equipment life.

Another automatic method, using a fine vapor of atomized oil carried to the friction surfaces in an air stream, is arousing considerable interest because of recent improvements. This system has been developed to lubricate bearings, rollers, gears, chains, and friction surfaces such as slides and ways. It also has been very successful in the lubrication of ultra high-speed spindles.

Proponents of the oil fog method point out that in addition to providing uniform lubrication, the constant flow carries away heat and provides protection against abrasives and dirt. Because a minimum of oil is involved, friction resulting from over-lubrication also is eliminated. Oil fog systems have solved many difficult lubrication problems and, as more experience is gained, many new applications can be expected.

The use of sealed bearings and graphite-impregnated metals and graphite bushings to meet special lubrication problems has increased in recent years. Sealed bearings are particularly useful when conditions such as corrosive atmospheres or vapors exist, or where inaccessibility is a major factor. Graphited metals are particularly useful for submerged applications and for installations where bearings must be run dry because of excessive heat or danger of possible contamination of products by fluid lubricants.

Purification

The present high costs of repairing or replacing equipment has caused much concern over means to extend its useful life. Since effectiveness of lubrication is a vital consideration, much research has been carried on in an effort to develop improved methods of purifying lubricating oils.

Improvements in design and materials have made filters increasingly effective in removing insoluble contaminants. For internal combustion engines, full-flow filtering has gained in favor over bypass, shunt, or batch filtering because it offers maximum protection against contamination. Full-flow filters also can be expected to replace bypass and full-flow straining methods now being used on many types of equipment which require a high degree of filtration, such as torque converters and hydraulic systems.

Improvements in the effectiveness of cotton, wool, felt, and cellulose filtering media have made these types especially popular for the removal of suspended solids from diesel lube oils. When soluble contaminants are a problem, fuller's earth is commonly employed as the filtering material. This medium removes most of the insoluble material and absorbs many types of soluble contaminants, but does not remove any appreciable amount of water sometimes encountered in diesel lube oils. Considerable care also should be exercised when using oils containing additives, since fuller's earth has a strong attraction for detergents, oxidation inhibitors, and corrosion inhibitors.

Reclaimers are finding widespread application where large quantities of oil are used, or when contamination of the lubricant is excessive. These units combine a series of heating, vaporization, and filtration processes. Their use has been somewhat restricted in some instances, however, since the drastic semi-refining operation removes most of the additives from oxidation-inhibited or detergent oils. Consequently, it must be recognized that the end product is of the straight-mineral oil type. Replacement of additives is not usually feasible because extensive tests are required to determine the proper type and amount to be added.

Vibration and Noise Control

I&P Annual Review

Faced with the possibility of paying Workmen's Compensation claims for loss of hearing, management is giving more thought and budget consideration to the problem of reducing noise levels in the factory.

FACTORY NOISE can permanently impair hearing. For many years, Workmen's Compensation Laws have held the employer liable for on-the-job accidents that have caused the employee to lose wages. Recently, two judicial interpretations have upheld test cases claiming impaired hearing as grounds for compensation. Estimates that more than $2 billion of claims can potentially be filed against employers, serves to underline some of the extremely serious implications of the industrial noise problem.

Future Responsibility

In the future, it will be the increasing responsibility of management, plant supervision, and the engineering staff to see to it that:

(1) Wherever possible, noise is reduced below levels which are determined to have a permanent detrimental effect upon hearing.

(2) Employees are protected—with ear plugs or other suitable devices—when working in areas in which noise cannot be reduced to avoid damage to their ears.

(3) Health and personnel records show a history of the employees' hearing ability and his exposure to noise to help substantiate or disallow future claims made under Workmen's Compensation.

(4) Medical and industrial research are stimulated. A more accurate knowledge of certain factors such as, noise level, length of exposure, type of noise, frequency, intermittency or continuity of the noise, is necessary for a proper evaluation of their effects.

Designing for Noise

The simplest, cheapest, and easiest way to reduce noise is to take it into consideration at the time the plant structure is designed and the facilities and machinery installations are laid out. The solutions seem almost obvious in the initial design and layout stages.

Segregation—Extremely noisy machines and noisy operations can be segregated. Compartments built either of full walls or partial baffle walls of acoustical material prevent sound waves from reverberating throughout the entire length of a building or room.

Exhausts — Internal combustion engines are best exhausted direct to the outside atmosphere. If that is not feasible, a muffler or manifold and muffling arrangement is recommended. Air compressors, and even high pressure air guns, are noisy if not properly muffled or exhausted.

Machine Mountings—The many types of machine mountings and suspensions already on the market are continually being improved in the efforts to reduce machine vibrations and noise. Vibrations are damaging to machine parts, often causing severe wear, with the resulting harsh grating, rattling, or squealing noises. Multiplied and extended over a period of time, these noises add considerably to the over-all plant noise level.

Metal-to-Metal Contact — Wherever there is metal-to-metal contact there is almost invariably a noise condition. In punch presses, brakes, shears, and metal saws, it is virtually impossible to avoid. On the other hand, where there is metal-to-metal contact in materials handling equipment—conveyors, pallets, tote boxes—certain changes can be made. If the conveyor rollers are of hard rubber, the tote box of wooden construction or bumpered with rubber, the pallets covered with a sound deadening material, for example, it is possible to reduce the metal-to-metal sounds commonly associated with these operations in the plant.

Enclosures — Power transmission devices such as chains, belts, and gears, will operate more quietly if

Owens-Corning

Fiberglas baffles have cut down noise from die cutting operations so that it is possible to carry on normal conversations in this printing plant area.

enclosed. Metal enclosures can be coated or lined with sound deadening material.

Furnaces—It has been found that proper types of burners and proper positioning of these burners will reduce the roar of the furnace.

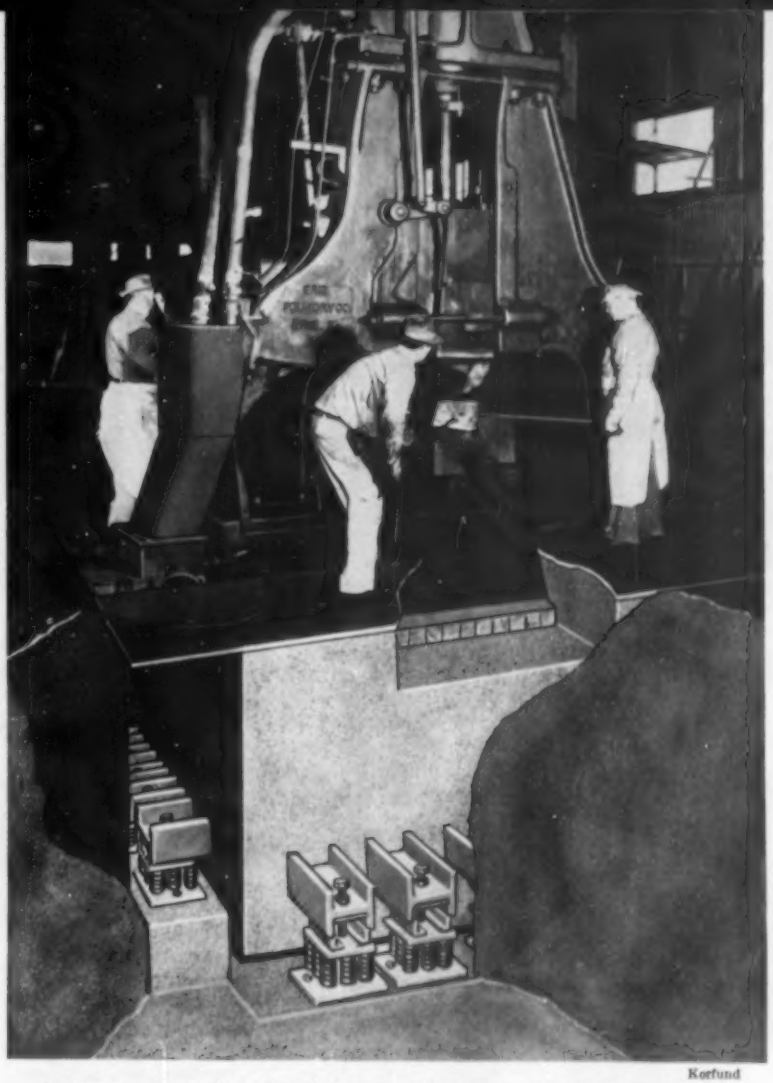
Acoustical Board—Used on walls and ceiling, acoustical tile and board may reduce reverberations of sound waves in a room.

Motor and Turbine Speeds—High frequency whistling and piercing noises from high speed turbines or electric motors or generators are avoidable. A combination of vibration mountings, sound deadening insulation and compartmenting with acoustic baffles, is a possible solution. The manufacturer of the orignal equipment can often specify the right type of enclosure, recommend lower operating speeds, or suggest further alternatives.

Sound Deadening Coatings—Large sheets of metal which are subjected to riveting or air hammer operations can create high levels of noise. A layer of sound deadening plastic or strips of coating on the back of the metal sheets will do much to dampen this noise.

Blowers—Fans and blowers are another source of irritating noises. Shielded from the working areas and properly suspended or mounted, they should not disturb personnel.

These are some of the more obvious and general solutions which will help guide the design engineer or plant layout man to reduce noise. Taken into consideration in the preliminary stages, they will probably save later corrective actions that try to reduce noise after the building is completed and the machinery installed ond operating.



Korfund

A cutaway view of the foundation for a 300 lb ram showing specially designed steel-spring vibration isolators used to reduce shock tremors.

Existing Noise Conditions

Maintenance will eliminate many noise conditions in a plant. Grinding gears, leaking air lines or air guns, worn springs, flattened cams, and eccentrics, are all noisy. A check list of maintenance work with a scheduled inspection of all machines and service facilities will do much to reduce noise level. Many of the design suggestions are equally applicable to existing noise conditions in the plant.

Comprehensive Program

Some pioneer work has been done in attempting to develop a comprehensive program for controlling noise and its effects. Such a program could consist basically of three parts:

(1) Measuring the noise level in all parts of the plant and carefully determining and marking those areas which exceed an arbitrary figure of 90 decibels in intensity.

(2) Setting up shop committees to help suggest methods for reducing the noise level at the various disturbing operations. At the same time initiating engineering, maintenance, and operating changes that will implement these suggestions.

(3) Testing personnel to determine their ability to hear.

Summary

To summarize—the problem of noise is an old one. But recent court action making the employer liable to claims for impaired hearing have emphasized the problem and intensified previous constructive efforts.

The best way to deal with industrial noise is in the early stages of design and plant layout. And in the future, noise will almost certainly be given consideration along with heating, lighting, and ventilating, in the preliminary planning of the plant and machinery.

In an existing plant the problem of reducing noise becomes difficult and expensive. Good maintenance is probably the most effective method. Minor changes and alterations can help lower the noise level. On the other hand, many noisy operations will continue to exist because little can be done to change the fixed installation without major disruption of production or without spending large sums of money.

Noisy areas may cause plants to adopt a comprehensive program. Employees working in these areas can be regularly tested and guarded against any permanent loss of hearing. Smaller plants that cannot afford specialized testing equipment or medical facilities may wish to pool their resources to make available these services.

Industrial Lighting

I&P Annual Review

Supplementary lighting for specific industrial tasks is taking on increased importance. Some swing to 277-volt systems is indicated.

INDUSTRIAL LIGHTING is a good indicator of American industry's changing nature. For the characteristics of lighting systems closely follow the needs of, and therefore indicate changes in, the configurations of production systems layouts.

As production began to expand beyond small shops and to occupy large continuous areas, so lighting systems kept pace by providing broad areas of uniform illumination in contrast to older "point" lighting methods. Today's emphasis on precision, automatic operation and control, and on close inspection is returning some emphasis to "point" lighting. The current demand for supplementary lighting in addition to the high levels of area illumination is raising the standards previously thought to be adequate under modern area lighting systems.

A great deal of the impetus for present high standards of minimum lighting levels has come from advisory organizations which have been working continuously in the field. But industry itself has also realized that its capital investments cannot produce their full capacity if they cannot be seen adequately. Worker comfort and efficiency certainly reduce spoilage and reduce machine damage; this means more safety, less down time, less turnover and more production.

Semi-direct lighting is coming in for more extensive use. Fixtures are being used which may direct from 5 to 40 percent of the total light upward; RLM specifies 20 to 30 percent and a shielding angle of 27° (from horizontal). Units are available with shielding angles from 13° to 35°. The actual illumination "wasted" by such methods is negligible, especially when compared to the value of reduced glare and increased comfort. In some cases, actual foot-candles delivered to work surfaces increase. At any rate, the insistence on direct lighting is giving way to the semi-direct methods which eliminate the irritating difference between bright fixtures and the dark areas formerly behind them.

Though there are many lighting systems hooked up independent of power circuits, many are being hung off of power systems to avoid duplicating secondary runs. Some circuits use the dry-type transformer to bring power voltages down to acceptable lighting voltages. The heavy emphasis on 480-volt secondary systems in power networks permits another arrangement; the lighting voltage can be taken line-to-neutral from a 480-volt line and still come under the 300-volt level specified by the National Electric Code for lighting fixtures. Thus the lighting system is supplied at 277 volts.

Control of the higher voltages for lighting is being provided by 120-

Austin Co.

Good levels of over-all lighting are supplemented by individual lamps to give ideal illumination for close work.

and 24-volt control systems. The higher voltage is being used in industrial circuits and the lower voltage control circuit is being applied in office and commercial work.

New Sources

It's a far cry back to the carbon-filament lamp and it will soon be even farther back; development of new light sources is continuing as is the broadening of application for existing devices. Perhaps of most concern to the plant engineer may be the high-frequency fluorescent systems which will require converter systems for changing 60-cps to 360-cps power for lighting.

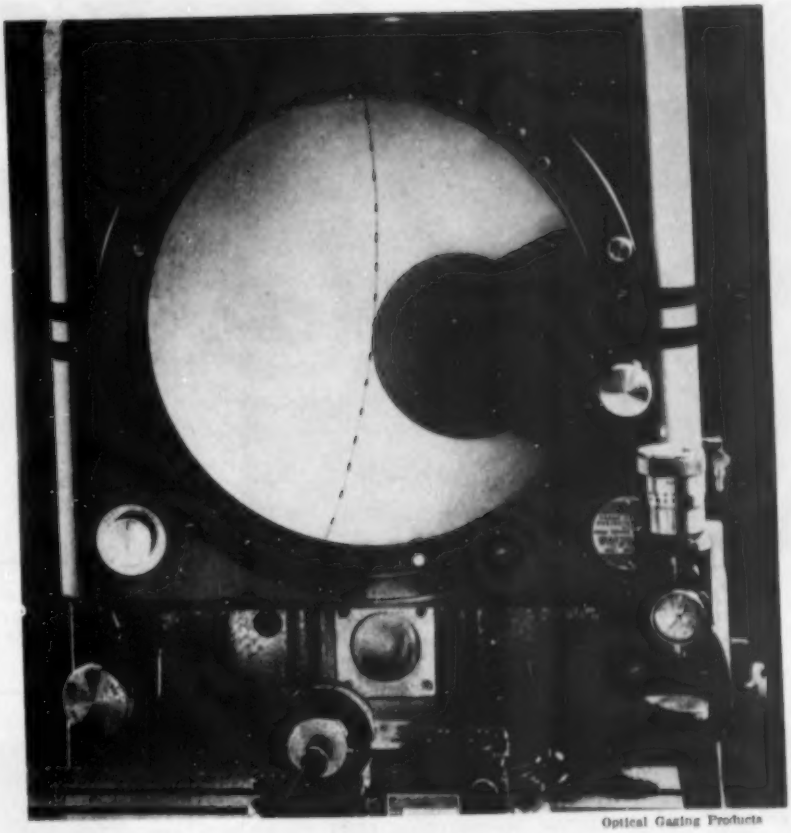
Using a magnetic frequency converter, a square-wave of the higher frequency is generated, producing several interesting results in the lighting system. The square wave form has a much higher rms than the standard sinousoidal wave, meaning more light per lamp for a given peak voltage rating. Flourescent flicker is practically eliminated because of the higher frequency and because the steeper front of the square wave means considerably more "on" time and negligible "off" time in each cycle. Ballasts can be smaller and will throw off less heat.

Other sources being worked on include the color-corrected mercury vapor lamp. These will probably still have to be banked with standard incandescents on account of re-starting and color characteristics. But they do have great advantages in efficiency and life over incandescents and find wide application in high-bay installations.

Special Applications

Protective lighting of buildings and grounds continues to be a problem faced by many plant engineers. Supplementary lighting combined with special optical devices for inspection and precision work is coming in for more emphasis. There is a practical limit on intensities of area lighting and there is great advantage in combining magnification of small parts with supplementary light in a single device.

Warning and control lighting properly come under consideration of the control systems of which they are an integral part; an exception may be the battery-powered emergency lighting packs which are showing up in increasing numbers. These are in effect warning lights for personnel. Where specific legal requirements do not exist, certainly a sense of precaution is dictating to many that an investment in these emergency lighting units is wise.



Optical Gaging Products

Specialized application of light for industrial inspection (above) for checking cam contours.

Emergency lighting fixture (right) uses battery whenever the normal source of power fails.

Light for non-critical seeing tasks (below) is provided by the rows of fluorescent fixtures.

Electric Cord

Sylvania

Fire Protection

I&P Annual Review

With the pessimistic (but practical) assumption that a fire can start anywhere, anytime—engineers are finding better ways, not only to minimize the possibility of an outbreak, but to effectively control it.

THE GENERAL MOTORS FIRE at Livonia has brought many comments on the adequacy (or inadequacy) of industrial fire protection codes, methods, and actual installations of protective equipment.

Such "soul-searching" by industry is not expected to bring about radical changes or new innovations in fire protection designs and systems. It is hoped that it will make industry more conscious of fire hazards and protective measures available—the latter information having been "preached" for many years by insurance companies, fire protective associations, and equipment manufacturers.

Wrong Assumptions

This fire, and others, have perhaps served to deflate some long-held and widespread opinions:

(1) There is no such thing as a fireproof building. Any material will burn if brought to its igniting temperature. The best (and most honest) claims are that certain materials are fire-resistive. With this in mind, it is a mistake to rely on fire-resistive materials to provide positive fire protection.

(2) Spot sprinkler protection is not adequate by itself. To be fully effective, sprinkler protection should cover a major portion of the plant area and facilities.

(3) It is one thing to prevent the outbreak of a fire and another to control its spreading. The first means effective precautionary measures—proper handling of inflammable materials; personnel fire and smoking rules; disposal of inflammable waste; proper storage of combustibles. The second, to control a fire from spreading, depends on the design of the fire protection system—firewalls and fire curtains, roof vents, sprinklers, alarm systems, local fire brigade, all areas within reach of fire extinguishing equipment.

(4) Fires start and spread as a result of a combination of factors. The Livonia disaster affords an excellent example. A welders' spark, an open drip pan, no sprinkler protection, an oil-soaked wooden-block floor, asphalt in the roof, are some of the factors—any one of which might have been responsible for permitting the original outbreak or preventing its subsequent control.

(5) Fire protection is a full-time professional job. The final authority for determining the adequacy of a fire protection system should rest with organizations like the National Fire Protection Association or Factory Insurance Association. Similarly, any fire-fighting plans should revolve around the local fire organization or its counterpart.

Protecting Investment

Capital equipment and plant facilities represent a sizable investment, neither one being easily or cheaply replaced. Add to that the production loss that a fire could cause, and there is justification for the tendency towards more fire protection equipment. It appears too, that insurance rates will be more favorable over a long period of time. This will help to liquidate the cost of new or expanded fire protection systems and equipment.

It is interesting to note that in a survey of big fires (individual losses of $250,000 or more) made by the National Fire Protection Association in 1952, they found that 66 percent of the plants had excessive areas without division walls; 70 percent lacked adequate automatic sprinkler protection; 32 percent used flammable liquids without proper protection; and 21 percent delayed in notifying the local fire department.

Future Trends

The future trends will probably rectify many of these shortcomings.

Fire walls, curtains, or doors will be incorporated in building designs having large, unbroken areas of floor space.

Fire resistive materials and paints will be further utilized. Especially where potential fire hazards exist.

Alarm systems, to operate in conjunction with automatic sprinklers, will immediately warn the fire department whenever a fire starts.

Automatic sprinklers will continue to be the single best measure to assure fire protection.

Dangerous process operations can reduce their hazards with automatic sprinkler systems and with fire walls, to mention two methods.

Remotely located plants may install their own fire brigades.

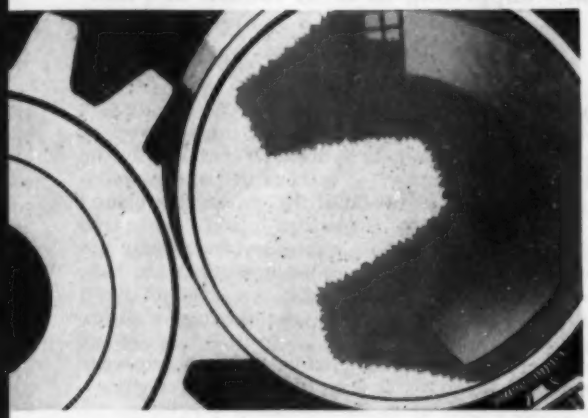
As the plant is improved, or as additions are made, fire protection systems will have to be continuously checked to see that they are still adequate for the new changes.

By these and other means, it is hoped that industrial fires will be reduced to a minimum. Certainly, properly engineered fire protection systems should effectively localize the extend and minimize fire damage.

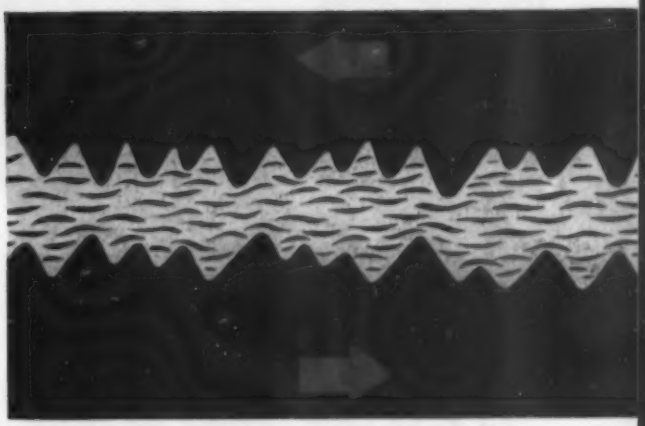
Alsynite

Self-extinguishing, fire-resistant translucent fiberglass panels are typical protective materials.

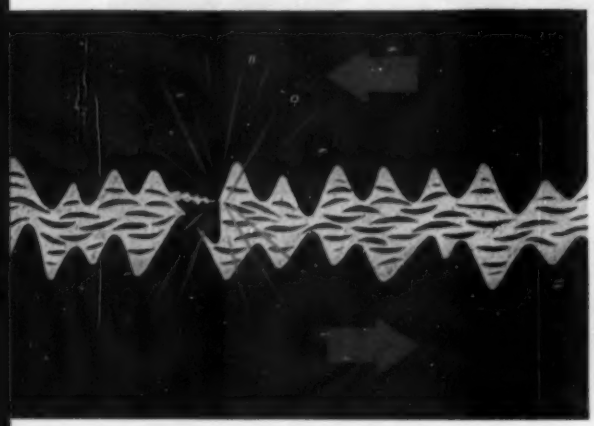
HOW SUNEP PREVENTS GEAR WEAR



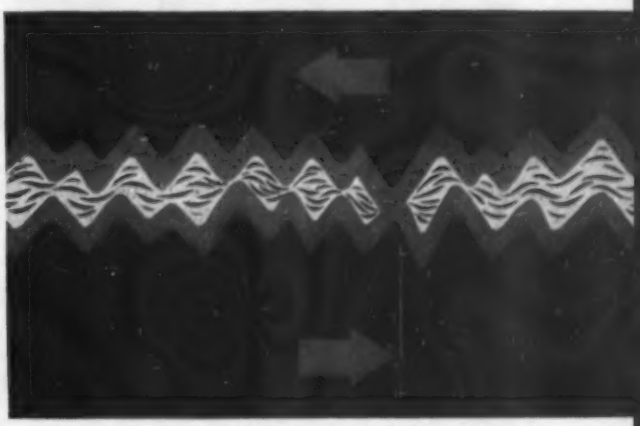
The surface of a gear may seem smooth, but when greatly magnified it looks something like this. The lubricant must keep these jagged edges apart.



With ordinary oil, a thick film is needed to keep these metal surfaces apart. The thickness of the film depends on the viscosity of the oil and other factors.



It is difficult to maintain a thick oil-film in everyday practice. The oil film thins out and semiboundary lubrication results. With ordinary oil, metal to metal contact occurs and gears wear.



Sunep coats the surfaces with a chemically bonded film which is virtually unbreakable. This film, although only about 0.0000001" thick, keeps the surfaces apart, withstands heavy loads and sudden shocks, prevents wear.

Sunep has many advantages. In addition to its outstanding load-carrying ability, it is noncorrosive; it keeps gears and bearings clean; it prevents rusting; it stays put. And its additives do not drop out during use or after prolonged storage. For more information about Sunep and how it protects your equipment, call your nearest Sun office or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. IP-1.

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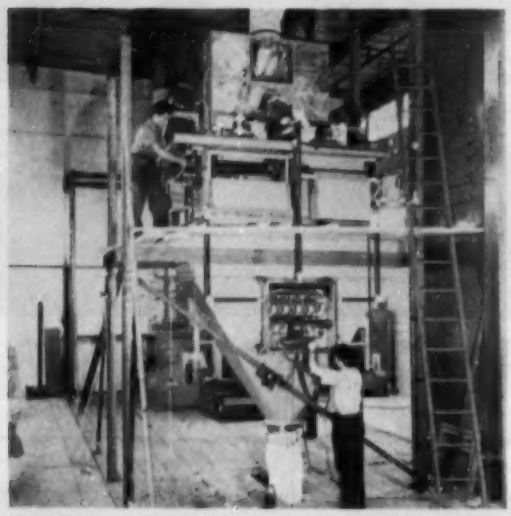
spot news

. . . what's happening in U. S. industrial plants



Laboratory Studies Solids in Flow

While there is a great deal of information available about the behavior of liquids in motion, little is known about the characteristics of solids in flow. One of the few groups currently attempting to enlarge this knowledge is the group of research engineers at the Richardson Scale Company's experimental laboratories.

A $150,000 investment, the laboratory facilities include a complete machine shop, electrical lab, solids-flow lab, and test quarters.

So far, considerable data have been collected on the pressure exerted by different materials on the bin discharge opening and on the lateral and vertical pressures existing at different points within the material mass. It is hoped that a general equation may be evolved for flow in any bin of symmetrical shape.

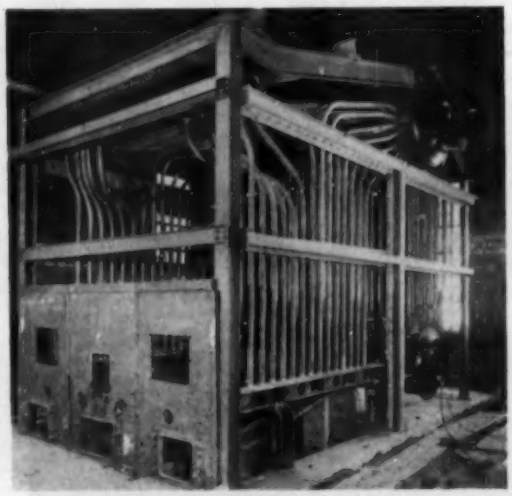
Besides working on new ideas and coming up with new and improved equipment, the laboratory engineers are frequently called on to solve special problems in materials handling that arise in a particular plant and are forwarded to the lab for study. As answers to these inquiries, the lab has designed such pieces of special equipment as a scale for weighing flour on the stream, a continuous proportioning and blending system that consists of an E20 Richardson scale synchronized with a Glengarry scale, and a machine for dumping one-ton cartons loaded by the bulk packer.

Hydraulic Rams Hold Pressure On Vulcanizing Platen

In large iron mines where conveyor belts, up to three miles long, and costing millions of dollars, are used the repairing of these belts is a constantly recurring job. One such mine has built a special building expressly for use in renewing conveyor belt surfaces.

Resourceful engineers responsible for these operations utilize a 30 ton center-hole hydraulic ram made by the Owatonna Tool Company at each corner of the platen to maintain even pressure until the vulcanizing operation is completed. Two vulcanizing platens with four rams to each platen are in operation throughout the winter season when actual mining operations are suspended. The rams are hooked up in series to one pump in order that equal pressure may be obtained simultaneously at each ram.

Until these rams were installed vulcanizing costs were approximately $3.90 per ft. Installation of this new system reduced these costs to $1.80 per ft.



Horizontal-Return Boilers Retired After Twenty Years

After almost 20 years of continuous service, four 150 hp horizontal-return tubular boilers are being replaced by three 262 hp water-tube boilers at the Old Fitzgerald distillery owned by Stitzel-Weller, Louisville, Ky.

Both the old and the new boilers were supplied by the Henry Vogt Machine Co. Westinghouse underfeed stokers are used to feed low rank Western Kentucky coals.

The new boilers have fusion welded drums designed for 160 lb per sq in. working pressure; roof and sides have water walls. The first of the three units, installed in February of 1953, operated for 50 days carrying the total plant load, reaching peaks of 30,000 to 32,000 lb per hr. Two boilers are now operated full-time with the third on a stand-by rotation basis.

Although the distillery makes only a maximum of 200 barrels of Old Fitzgerald a day, their boiler requirements call for more equipment than might ordinarily

be used in a distillery of this size. The sour mash distillation method used being longer and slower than the conventional sweet mash method, requires a heavier and more continuous load of steam.

Pneumatic System Reduces Cost and Time for Unloading

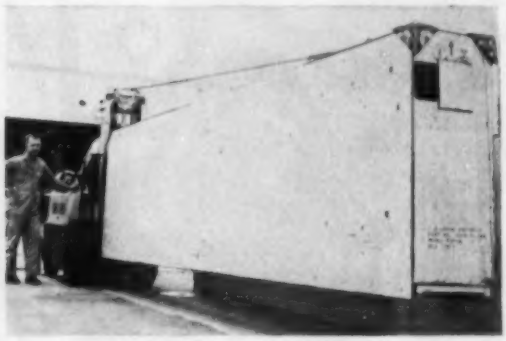
Through the use of pneumatic handling systems for unloading and storing granular material, several U. S. industrial plants are realizing savings in handling and labor costs.

The system, as worked out by the Beaumont Birch Company, is simple. The only requirement is a bin that is airtight and will withstand pressure

A partial vacuum is created within the bin by means of a steam actuated vacuum producing unit or by a mechanical exhaust system. A hose with a gulping tool connects the bin with the freight car. When the exhauster is started, the material is drawn out of the car directly into the bin.

When the steam exhauster is used, it discharges into an air washer where the steam is condensed and the air washed before discharge to the atmosphere. With the mechanical system, the exhauster is placed after the washer.

While the usual unloading time without this system is from 8 to 16 hours, depending on the number of men used, pneumatic handling enables one man to unload a car in four hours.



Long Crates Moved by Fork Truck and Harness

The problem of heavy crates that are too long for one lift truck becomes acute in the case of a firm like TEMCO Aircraft Corporation whose products require crates more than 30 ft long. To overcome this problem, a system was developed that requires only one lift truck, an operator, and a special harness.

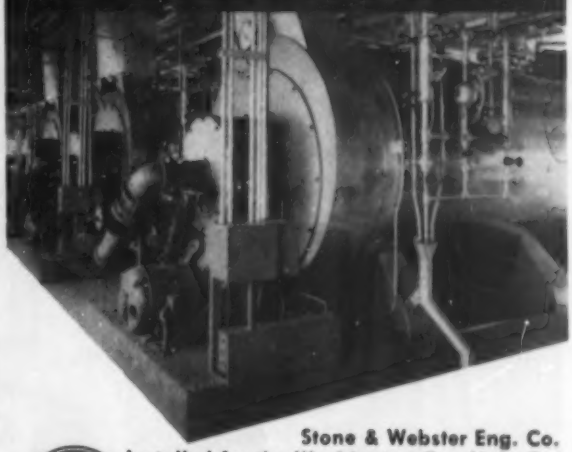
The harness consists of two 8 x 8 in. scrap steel plates and two lengths of ¾ in. link trace chain and enables the three or four-ft forks on a lift truck to support, lengthwise, an object many times their length.

The lift truck operator runs the truck forks under one end of the crate and then hangs the steel plates on the upper two corners of the crate's far end. The plates are fitted with metal points which bite into the crate to prevent slippage.

Plates are joined with a length of chain long enough

(Continued on page 112)

For steam demands ranging from 2,000 to 50,000 lb. per hour....



Stone & Webster Eng. Co.
Installed for the Washington Gas Light Co.

CYCLOTHERM
CYCLONIC COMBUSTION!

At its new gas storage plant in Rockville, Md., Washington Gas Light Co. faced a complex steam problem. The winter load averages only 2000 lb. per hour at 15 psi with no superheat. During extremely cold weather, however, send-out loads require as high as 50,000 lb. per hour—and it must be supplied immediately.

To meet this problem efficiently, four 500 hp Cyclotherm gas-fired steam generators were installed with 17,500 lb. steam capacity per hour each. Any single unit supplies normal needs, a combination of any three meets peak loads quickly.

Ability to reach full capacity from a cold start in only 15 to 20 minutes was a prime consideration. Using the *patented* Cyclonic Combustion principle, air enters the combustion chamber at extremely high velocity in a free spiral vortex. Fuel introduced into the entering air is slowly consumed as it travels through the combustion chamber. This highly luminous, slow burning flame—radiating heat to the fire tubes through direct radiation and by convection—results in an unusually high rate of heat transfer, rapidly building to full-rate steam capacity.

ADDITIONAL FEATURES

1. Two-pass design which reduces fuel consumption and saves up to ⅓ the space of conventional steam generators.
2. Compact, standardized package unit fully equipped with burner, appliances and controls.
3. Automatic operation which confines boiler attendance to periodic checkups.
4. Minimum refractory materials which results in reduced labor, time and cost of maintenance.

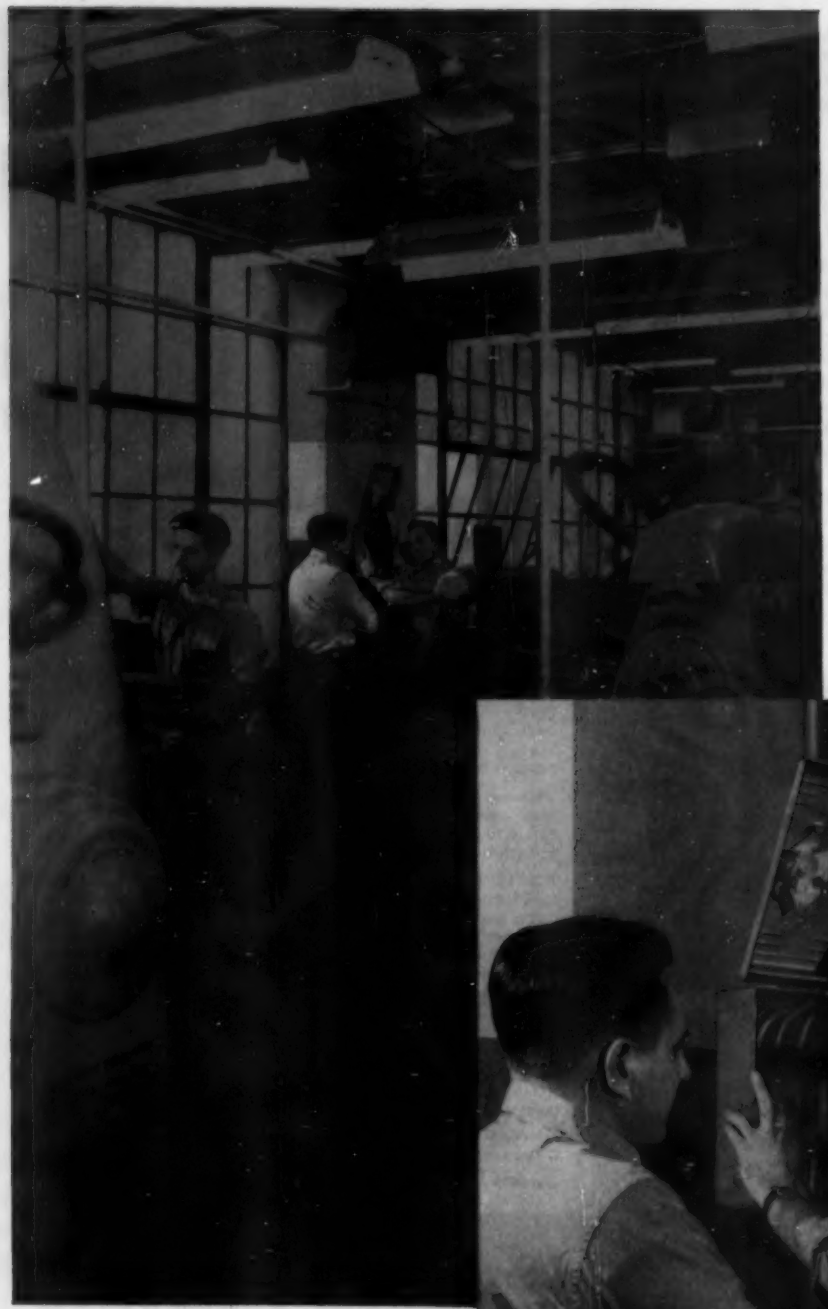
Cyclotherm Steam or Hot Water Generators are made in sizes from 18 to 500 hp, 15 to 200 psi operating pressures. Write today for full descriptive literature.

Just drop a card to Cyclotherm, Dept. 38, Oswego, N. Y.

CYCLOTHERM® STEAM GENERATORS

CYCLOTHERM DIVISION UNITED STATES RADIATOR CORP.-OSWEGO, NEW YORK

Circle 540 on Reply Card for more data



Here's a good reason why
It's wise to buy
On over-all cost . . .
not price

I-T-E

Engineered for dependable, economical circuit protection

I-T-E Circuit Breakers protect your workers too!

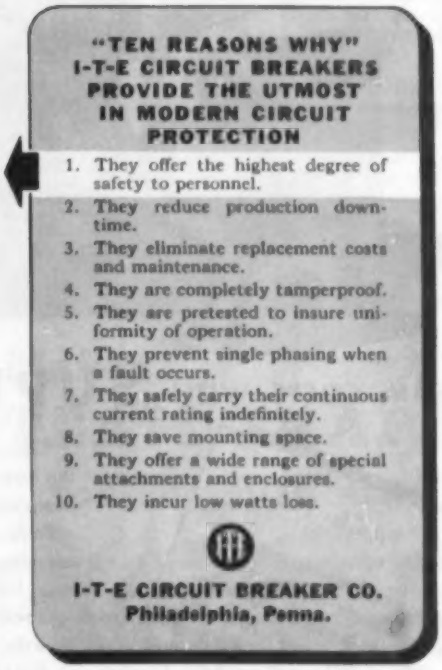
Safety is a prime consideration in the purchase of any electrical protective device. The man on the machine must have the safest equipment human ingenuity can devise.

That's just *one* good reason why it pays to install I-T-E Circuit Breakers. They're *safety-engineered*—to protect your *workers*, as well as your equipment.

I-T-E Circuit Breakers are completely enclosed by insulated molded cases. They cannot be held closed against overloads or short circuits. Thus, accidents are averted.

Remember—in electrical protection, *over-all* cost is the cost that counts. Check with your local I-T-E distributor, and see how much more economical modern I-T-E Circuit Breakers really are—compared with *fusible-type* protective devices.

I-T-E Circuit Breaker Co., 19th and Hamilton Sts., Philadelphia 30, Pa.


"TEN REASONS WHY"
I-T-E CIRCUIT BREAKERS
PROVIDE THE UTMOST
IN MODERN CIRCUIT
PROTECTION
1. They offer the highest degree of safety to personnel.
2. They reduce production down-time.
3. They eliminate replacement costs and maintenance.
4. They are completely tamperproof.
5. They are pretested to insure uniformity of operation.
6. They prevent single phasing when a fault occurs.
7. They safely carry their continuous current rating indefinitely.
8. They save mounting space.
9. They offer a wide range of special attachments and enclosures.
10. They incur low watts loss.
I-T-E CIRCUIT BREAKER CO.
Philadelphia, Penna.

The other side of this handy pocket card tells you how to select I-T-E Molded Case Circuit Breakers for various feeder and branch circuits. Write for card and other application data, or see your local I-T-E distributor.

I-T-E
Individually Enclosed Circuit Breakers

Circle 541 on Reply Card for more data

WHEN THE EMPHASIS IS ON **modernization**

CUT STEAM COSTS WITH SUPERIOR STEAM GENERATORS

LET'S FACE IT!

Fuel, labor and maintenance are the big elements of steam cost. They completely overshadow original cost of equipment. Fuel costs are higher, wages are climbing . . . and surveys show that 2 out of 3 boilers are obsolete . . . while competition in almost every field is keener. If you are looking for opportunities to cut operating costs, talk with a Superior engineer. Write for Catalog 502.

Complete, compact, and efficient, SUPERIOR Steam Generators are the easiest and quickest means to boiler room modernization. Shipped complete after factory tests which guarantee more than 80% thermal efficiency, SUPERIOR Steam Generators are designed for long-run economy, and backed by undivided responsibility.

Installation is simplified for speed and economy . . . requiring no special foundation, no expensive chimney other than a vent for exhaust gases . . . puts steam where used, eliminating long steam lines. Compact design saves space and construction costs.

Fully automatic operation with any grade of oil or gas assures maximum fuel economy with minimum supervision. Ample heating surface (min. 5 sq. ft. per b.h.p.) assures operation at capacity without overfiring. Built-in induced draft makes boiler rooms cleaner, quieter, and safer.

Modernize with a modern SUPERIOR Steam Generator.

for performance you can **BANK** *on*

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N. Y.

SUPERIOR STEAM GENERATORS

Circle 542 on Reply Card for more data

readers' guide

. . . an index to advertised products

The table below lists, according to product groupings, all equipment advertised in this issue. To request more data, circle key numbers on Reply Cards, pages 36/37 & 92/93

Key No.	Advertiser	Product	Page No.
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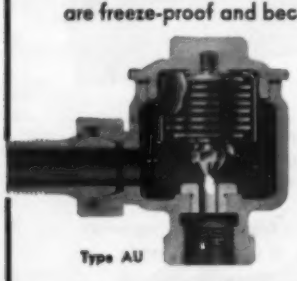
(Continued on next page)

Nicholson Makes
FREEZE-PROOF STEAM TRAPS
for Every Plant Use

Because they drain completely when cold, these four types of Nicholson steam traps are positively freeze-proof. Can be freely installed outdoors. Universally recommended for use in lines which need not be in continuous use during cold weather, because they are freeze-proof and because their 2 to 6 times average drainage capacity results in minimum heat-up time. The non-air-binding feature of Nicholson traps also notably facilitates steam transfer in severe weather.

TYPES FOR EVERY PLANT USE—process, heat, power; size 1/4" to 2"; pressures to 250 lbs.

Catalog 953 or see Sweet's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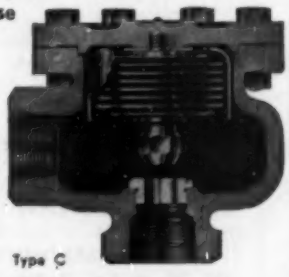
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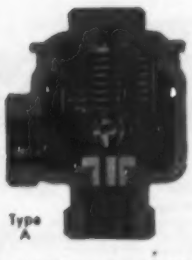
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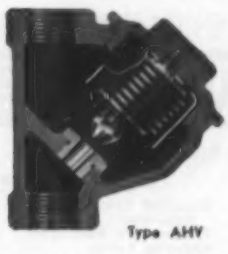

Type AHV

W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

135 OREGON ST., WILKES-BARRE, PA.

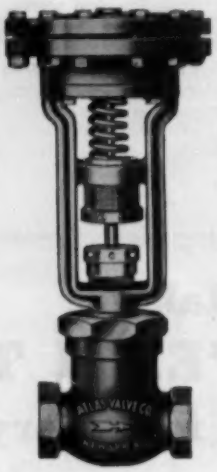
Representatives, in 58 Principal Cities, to Help You Solve Specification and Maintenance Problems in Traps, Floats, Control Valves

Circle 543 on Reply Card for more data

ATLAS

Type "D" REDUCING VALVES

The exceptional valve shown here is our ATLAS Type "D". In our 52-page Bulletin 1-A it is shown as Fig. 171. If you need reducing valves be sure to ask for Bulletin 1-A as it gives complete information concerning a wide range of regulating valves for steam, water, air, gas or oil. Ever since its introduction Type "D" has made a "hit" with users. It is unusually simple. Gives accurate and close regulation of pressures. Is easy to inspect. Stainless steel or bronze seat rings. Stainless steel or composition discs. Stainless steel valve stem. Removable diaphragm top. Adaptable to steam, air, or gas. Good for up to 300 lb. initial pressure. Durable. Body of bronze. Screwed or flanged ends.



WHAT'S YOUR REGULATING PROBLEM?

For best results, whatever your regulating problems may be, form the good habit of always placing them in the hands of ATLAS engineers. Your requirements will be given their competent and prompt attention. For more than a half century ATLAS has been specializing solely in regulating valves. Type "D", shown here, is a result of that specialization.

See list of other ATLAS products below.

ATLAS VALVE COMPANY
REGULATING VALVES FOR EVERY SERVICE

287 South St. **Newark 5, N. J.**

Represented in Principal Cities

Campbell Boiler Feed Regulator
Temperature Regulators
Reducing Valves
Exhaust Control System
Pressure Regulators
Pump Governors
Damper Regulators
Back Pressure Valves
Balanced Valves
Control Valves
Float Valves

Circle 544 on Reply Card for more data

readers' guide

—Starts on page 93

Circle key numbers on Reply Cards for more data

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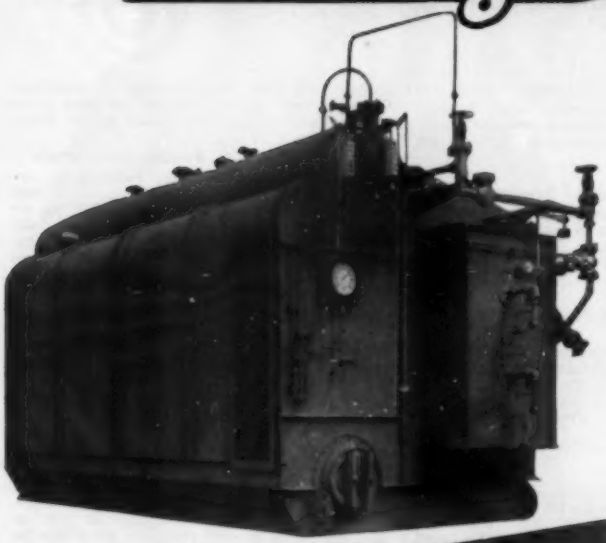
507	National Aluminate Corp.	Water treatment	13
	MISCELLANEOUS		
549	Sweet's Catalog Service	Plant engineering file	100

Vogt

Gas Fired
PACKAGE UNIT
Steam Generators
selected by
PHILLIPS CHEMICAL CO.
Pasadena, Texas Plant



TOP: One of the completed units prior to shipment.

BOTTOM: Shop erection view shows tile and block insulation in convection wall; also main baffle tile and furnace floor tile.

Principal Data, Each Unit

25,000 pounds steam per hour capacity. Induced draft type.
Fusion welded steam and water drums designed for 425 pound S.W.P.
Completely shop assembled and required only the piping and gas outlet connections to place them in operation.
Fully steel encased for outdoor installation on a simple foundation.

•

**Vogt Steam Generators are available in bent tube types and straight tube forged sectional header types for solid, liquid or gaseous fuels. Bulletins on request.*

HENRY VOGT MACHINE CO.
Louisville, Kentucky

BRANCH OFFICES: New York, Philadelphia, Chicago, Cleveland, St. Louis, Dallas, Charleston, W. Va.

Circle 545 on Reply Card for more data

bulletins

. . . for listing of the bulletins just received see page 37

AIR FILTERS & DUST COLLECTORS

223—Dust Collectors

Dust collectors, including cyclone, wet or dry dynamic, and cloth screen arrestor types are the subject of a 32-page bulletin. Uses of air conditioning, ventilating, conveying, drying, and cooling units are presented by means of illustrated industrial installations. Kirk & Blum Mfg. Co.

224—Tubular Dust Collectors

Problems of fly ash collection are discussed in 8-page brochure 4P201. Tubular dust collectors are described, and efficiency curves, arrangements, and standard dimensions are presented. Flue gas density tables, and a formula and monograph for calculating the number of tubes required for any volume and resistance, are presented to aid in selecting dimensions for a unit to satisfy space requirements. The Thermix Corp.

BOILERS & BOILER ACCESSORIES

225—Steam Generators

The advantages of shop-assembled power for your plant with Type-A water tube steam generators are explained in 8-page bulletin 52-1. Line drawings show the flexibility of design possible and dimensions. The Wickes Boiler Co.

226—Draft Inducers

The biggest contribution to the cause of improved furnace operation in recent years has been the mechanical draft inducer, according to 12-page booklet I-52. Six causes of poor chimney draft are listed. Parts of a typical draft inducer installation are numbered and explained. A selector chart is included. L. J. Wing Mfg. Co.

227—Packaged Steam Generators

Construction of packaged steam generators is described in 8-page bulletin 1050. Auxiliary equipment is listed and a blueprint with dimensions of a typical boiler room layout is given. Ames Iron Works.

228—Flame Failure Explosions

"Guarding Your Properties Against Flame Failure Explosions," booklet CP21, shows how to determine whether your fuel burner is adequately protected against explosion and briefly describes equipment to provide complete protection. Combustion Control Corp.

229—Blow-off Valves

Up-to-date information on blow-off valves for pressures up to 400 lb is given in revised bulletin B426. Lists construction features, specifications, styles and dimensions. Numerous diagrams, tables and photographs give complete details. Valve selector table included. Yarnall-Waring Co.

Pressure Equipment

One of the country's oldest manufacturers of equipment and accessories for plants, piping, steam, air, and gas under pressure, has published catalog 400, covering its line of separators, traps, and boiler trim. A condensation of the information in catalogs 500, 600, and 700, the booklet gives adequate size and pressure tables and technical data on the most frequently and commonly used equipment. **Please send requests directly to Wright-Austin Co., 2345 Wight St., Dept. IP, Detroit 7, Mich., on company letterhead.**

230—Coal-Burning Installations

"Burning Bituminous Coal the Modern Way," contains 24 pages of case histories from industries of all sizes and types. Engineering survey results for equipment such as boilers, stokers, coal and ash handling units, and automatic controls, include annual fuel consumption and operating costs. Bituminous Coal Institute.

231—Boiler Baffles

"More Steam from Your Boilers," a 4-page folder, explains how streamlined baffles are applied to all types and sizes of the company's boilers. Drawings indicate how they are installed in each specific unit to secure crossflow of gases. The literature also points out how gas passes are tapered in area to obtain necessary velocity for maximum heat transfer. The Engineer Co.

232—Spreader Stokers

Reasons for firing with spreader stokers, together with distinctive design and operating characteristics of spreader stoker feeder units, are outlined in a 46-page brochure. Case studies point up construction details, advantages of traveling grate units, and installations. Riley Stoker Corp.

233—Water-Tube Steam Generators

Data and specifications for factory assembled units in sizes ranging from 5300 to 33,000 lb per hr are presented in an 8-page brochure. For pressures up to 400 psi, they are designed to provide fully automatic firing with oil, gas, or stoker-fired coal. Superior Combustion Ind., Inc.

234—Packaged Boilers

Packaged automatic boilers for light oil, heavy oil, gas, or combination gas and oil firing are featured in 16-page bulletin 1219. Ratings for 15 to 500 hp units are tabulated and installations for steam process and steam and hot water service are illustrated and described. Orr & Sembower, Inc.

235—Catalog

A wealth of research, engineering, and manufacturing experience, gained since the founding of this company in 1880, is incorporated in the products described in this 4-page folder. Steam generators, heat transfer equipment, pressure vessels, valves and fittings, and refrigeration equipment are shown. Henry Vogt Machine Co.

236—Boilers

Self-contained boilers for heating and processing are described in 7-page bulletin AD-100. Design is illustrated by a cross-sectional drawing and efficiency is shown by graph. Capacity and dimension tables are included. Cleaver-Brooks Co.

237—Spreader Stoker

Bulletin 897 describes a spreader stoker with overthrow rotors said to provide exceptionally uniform fuel distribution. Sizes and capacities for application to all types and makes of boilers or steam generators are shown in cross-sections and photographs. The units described will burn all grades of bituminous coal, lignite, wood, and refuse separately or in combination with coal. Detroit Stoker Company.

238—Firing Equipment

Over 50 years of leadership in the manufacture of industrial-commercial firing equipment is reflected in 19-page general catalog 3048. Schematic drawings, layouts of typical installations, cutaway views of burners and burner parts, and photographs of burners and installations are included among the many illustrations. Specifications and detailed data on exclusive features of this company's oil, gas, and combination oil-gas burners are given. Petro Division.

239—Cyclonic Combustion

Principles of the patented method of Cyclonic Combustion are explained in four-page folder, "All Your Questions Are Answered By Cyclotherm." Descriptive drawings show how air is introduced into the combustion chamber at extremely high

PRODUCT INDEX

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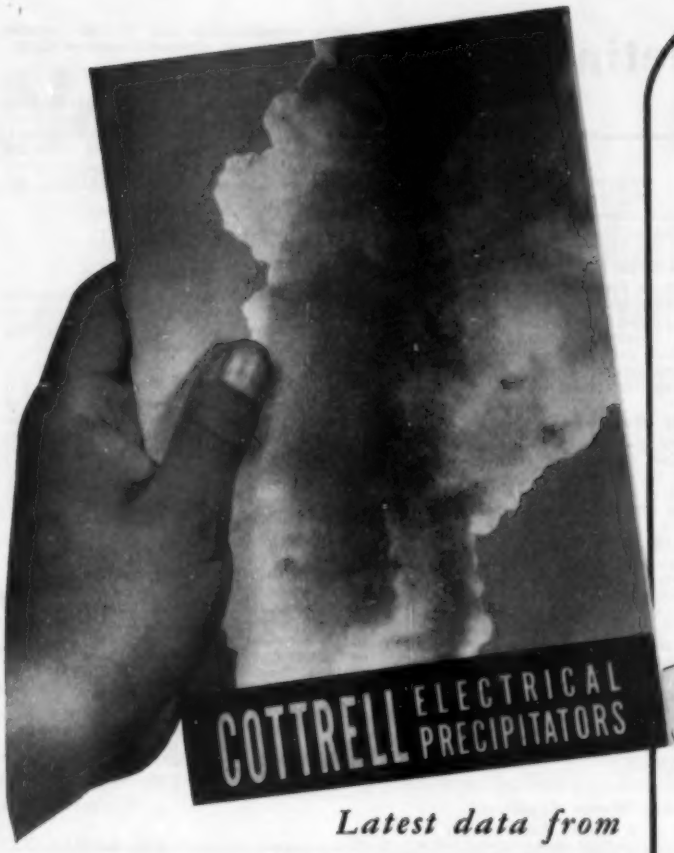
NOTE—Each bulletin item has a key number for your convenience in asking for a free, personal copy. Circle key numbers on Reply Card between pages 36/37 & 92/93.



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Do you have operations in your plant where gas-laden suspensions, wet or dry, are a problem? Such suspensions may be dropping on surrounding property, causing nuisance difficulties. Or perhaps important values are being lost in stack gases that can be profitably recovered. Whatever the nature of your recovery requirements, you will find this 40-page Cottrell booklet of great help. It contains up-to-date data on the latest advancements in the electrical precipitation field – prepared by the organization that pioneered the commercial application of Cottrell Electrical Precipitators almost a half century ago and has consistently led in new Cottrell developments.

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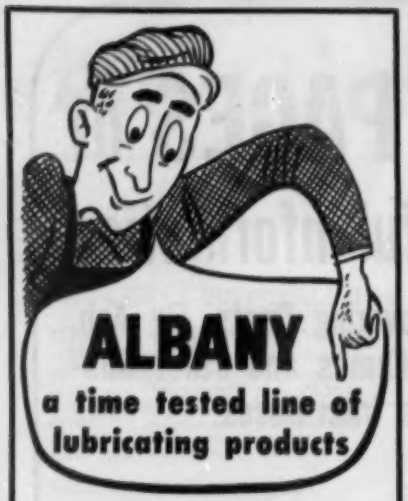

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speeds in a revolving spiral vortex, radiating heat to the fire tube through direct radiation and convection. Cyclotherm Division of United States Radiator Corp.

240—Three-Drum Boilers
A pioneer in the application of 2½ in. diameter tubes to three-drum boilers describes its Type "C" boiler in revised seven-page catalog SB-49. These high-pressure, high-duty units are shown by means of cut-aways. A table gives specifications. Erie City Iron Works.

240—Boiler Water Foam
Laboratory pictures in this 4-page folder show how Concentrol controls boiler water foam. Examples of its use in various industries are given along with an explanation of foaming. Bird-Archer Co.

241—Vertical Unit Boiler
More than 25 years of development, manufacturing, and application experience are reflected in the design of the Type VU-10 vertical-unit boiler described in 16-page bulletin VU 10-8. Advantages and design features are discussed. Various possible installations are shown by photographs and cross-sectional drawings. Combustion Engineering, Inc.

BUILDING MATERIALS & MAINTENANCE

242—Masonry Water Repellent
Discussed in a 4-page folder is an inorganic water repellent designed for brick, concrete, sandstone, stucco, asbestos cement combinations, cement base paints, and other composition surfaces. The bulletin explains how the product eliminates dampness on interior wall surfaces and lists many other advantages. The result of accelerated weathering tests are appraised. Flexrock Co.

243—Storage Systems
"Modern Industrial Storage Systems," 12-page brochure 4393, discusses the subject of storage for raw ingredients, semi-processed, or finished material. The flexibility and adaptability of concrete silos is discussed. Descriptions of component parts and construction are supplemented with line drawings. The Marietta Concrete Corp.

DIESELS & GAS ENGINES

290—Steam Turbines
Fully-illustrated 24-page bulletin 1961 emphasizes the flexibility of design of the type-S turbine which is said to make possible selection of the proper number of stages, governor, and controls to give maximum efficiency for your steam and operating conditions. Each component of the system is pictured and described. Worthington Corp.

244—Multi-Stage Turbines
Smaller framed, multi-stage turbines are featured in 6-page bulletin. Overspeed governor, governor valves, blades, diagrams, and many other design features are discussed and illustrated. The Terry Steam Turbine Co.

245—Gas Diesel Engines
Engines for gas, gas-diesel, and diesel operation described in 12-page booklet L-71, are 4-cycle, with 15½ in. bore and 22 in. stroke. A rating curve compares supercharged to atmospheric operation. Aftercooling for more horsepower is discussed. Space requirements and typical installations are shown. Cooper-Bessemer Corp.

246—Diesel Engines
Smaller and lighter, but for heavy-duty service is the description of a diesel engine discussed in 12-page bulletin 10027. Three models are listed, ranging from 200 to 380 hp at 900 to 1000 rpm. Specifications and performance curves are included. Ingersoll-Rand Co.

ELECTRICAL EQUIPMENT

247—Dry Type Transformers
How to use dry type transformers profitably in your plant is explained in folder DT 195 which also includes wiring diagrams. Acme Electric Corp.

248—Variable Speed Motors
How variable speed motors are used to improve production is described in 16-page brochure 1797. In addition to describing advantages the booklet describes design theory and construction features. Special controls, including both mechanical and electrical types, also are discussed. U. S. Electric Motors, Inc.

249—Fuses
Hi-Cap fuses for the protection of loads above 600 amp are described in six-page bulletin HCS. Two handy charts are included: Current Limiting Effect and Opening Time Curves. Use of these fuses in conjunction with Fusetron fuses is explained. Buss Manufacturing Co.

250—D-C Power
D-c power sources and supplies are described in eight-page booklet B-1049. Mechanical and electrical specifications are given for the Nobratron. Sorensen and Company, Inc.

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251—Motors
Three picture-story bulletins, GEA-6012, GEA-6013, and GEA-6027, contain complete descriptions of maintenance, performance, and protective features of Tri-Clad "55" motors. Each booklet includes a double-spread cutaway drawing of the motor. The three types discussed are the drip-proof, inclosed, and gear motors. General Electric Co.

252—Electric Clutch
Principles of operation of an electrically controlled clutch are explained in 16-page bulletin 5306. It gives engineering information on how to apply, how it operates, and control. Specifications are listed. Rectifier Div., I-T-E Circuit Breaker Co.

253—Dry-Type Transformers
"Operation and Maintenance of Dry Type Transformers," was written to guide maintenance personnel, management, and electricians in the proper installation and care of dry-type transformers. The simple trouble chart helps find trouble spots and points out the necessary remedies. Hevi-Duty Electric Company.

254—Fractional hp Motors
Construction features of Form "F" fractional horsepower motors are discussed in four-page folder 1-5, Pl. Tables and drawings show ratings, frame size, and dimensions. Century Electric Company.

255—Motors
Advantages of the various types of

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Brady Conveyors Corp.	Luminous Ceilings Inc.
Carrier Corp.	Modine Mfg. Co.
Chimney Engrng. Service Div., St. Louis Lightning Protection Co.	Morley Co.
	National Airoil Burner Co., Inc.
Clarage Fan Co.	National Conveyors Co., Inc.
Cleaver-Brooks Co.	Owens-Corning Fiberglas Corp.
Cochrane Corp.	Permutit Co.
Combustion Engineering-Superheater, Inc.	Reznor Mfg. Co.
Consolidated Chimney Co.	Schaub, F. H., Engineering Co.
Continental Chimney Co.	Springfield Boiler Co.
Cutshall, J. M., and Son	Trane Co.
Cyclotherm Div., U. S. Radiator Corp.	United Conveyor Corp.
Drava Corp.	Water Cooling Equipment Co.
Filtrine Mfg. Co.	Westinghouse Electric Corp., Sturtevant Div.
Graver Water Conditioning Co.	Wing, L. J., Mfg. Co.
Grinnell Co., Inc. Unit Heaters Fire Protection	Worthington Corp.
	Yarnall-Waring Co.

In other sections of the File you will find additional catalogs containing useful information on a wide range of products used in the maintenance of all plant facilities.

Sweet's Catalog Service

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bulletins

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motors made by this company are given in four-page folder 23. Descriptions of single-phase and polyphase motors are included along with a listing of their specifications. Wagner Electric Corp.

256—Motor Controls

"The ABC of Large A-C Motor Controls," is a 36-page special issue of the "E-M Synchronizer," No. 30, presenting in an easily understood manner basic facts helpful in the proper selection and application of controls for large industrial motors. Illustrations and charts are explained and discussed in the accompanying text. The booklet also includes discussions of the latest developments in motor and personnel protective features. Electric Machinery Mfg. Co.

FILTERS, STRAINERS & PURIFIERS

257—Valves and Strainers

Forty years of service are behind the information presented in bulletins 126-A (pipeline strainers) and 226 (pressure reducing valves). Cross-sections, tables, and diagrams are used to point out the advantages of this company's products. McAlear Manufacturing Co.

HEAT EXCHANGER EQUIPMENT

258—Temperature Control

A simple method of controlling the temperature of liquid or gas is explained in 4-page folder 120 on heat exchangers. Cutaway drawings illustrate how the units operate and flow diagrams show how controls keep a fluid at uniform temperature. Bulletin 111 gives uses of the Aeropass Condenser. Cross-sectional drawings explain the operation of both the wet bulb and finned coil models. Niagara Blower Co.

HEATING, AIR CONDITIONING, & REFRIGERATION

259—Heating Specialties

How to design a one-pipe hot water system is explained in 8-page booklet J-355. In addition to discussions, data tables and diagrams are included. Many types of heating specialties are described, including a circulator, flow valves and fittings, relief valves, vents, a charging valve, compression tank. The Trane Co.

260—Electric Comfort Heaters

Listed in 8-page catalog D-52 are 75 different models of forced air, convection, and radiant heaters in capacities of ¼ to 100 kw. Aids include a quick selector chart which shows how to calculate heat requirements for given areas and types of buildings. Edwin L. Wiegand Co.

MATERIALS HANDLING EQUIPMENT

261—Car Shakers

Car shakers for effective and economical unloading of hopper-bottom cars are described in 11-page bulletin 2345. Construction features, capacities, and advantages are listed. Four different models are shown by line drawings. Link-Belt Company.

291—Conveyor System

How a recently installed interfloor-conveyor system cut receiving-to-storage time is discussed in a reprint. The article tells how the system eliminated a long truck haul, stopped elevator congestion, and reduced unloading time of highway trucks. Included are descriptions of the vertical interfloor conveyor, feeder conveyor, take-away conveyor, and automatic control system. Gifford-Wood Co.

292—Rayon Belting

Transmission belting with rayon instead of cotton plies was proved in field applications for more than 4 years on jobs specially selected for their severity according to 4-page folder A5163K. Uses and advantages of the several types of Thor belting are listed. Goodyear Tire & Rubber Co.

MATERIALS OF CONSTRUCTION

293—Nickel Alloys

Helpful technical publications covering the many aspects of nickel alloys, and their applications, are listed in 2 bulletins. Instructions on how to order literature, free of charge, are included. The International Nickel Co., Inc.

LUBRICANTS & LUBRICATION EQUIPMENT

294—Lubricating Oil

Excellent time-temperature characteristics, and application by any method are advantages listed in technical data sheet 17, for newly developed lubricating oils. Physical properties and other advantages are discussed, and a chart shows service life characteristics. Sun Oil Co.

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MECHANICAL POWER TRANSMISSION

262—V-Belts

Fractional horsepower V-belts, for use in servicing light duty applications, are cataloged according to the new industry-standard numbering system. Various types of machines are listed alphabetically by company or trade names for convenience in determining the proper belt. Manhattan Rubber Div., Raybestos-Manhattan, Inc.

PACKING & GASKETS

263—Metallic Packings

Included in an 8-page leaflet are service recommendations for "V" metal insert packings, metallic valve stem, plastic core metallic face, all metallic, flexible metallic, high temperature aluminum, and braided copper packings. Standard sizes, packages, and approximate weights for each type are also listed. Raybestos-Manhattan Inc., Packing Div.

264—Power Plant Applications

How to get the best results from packings is outlined in useful 6-page folder PK-61-A entitled, "Packings for the Power Plant." Each of 28 types of packings and gaskets is illustrated, briefly discussed and numbered for quick reference. These numbers are then used on a schematic drawing of a power plant to indicate recommended applications. Johns-Manville.

PIPE, TUBING & HOSE

265—Prefabricated Conduit System

Introduced in 4-page folder 3210 is a newly developed large diameter, prefabricated conduit system for protection of underground services. Prefabricated to job

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2 VALVE PRINCIPLES
that save money for DARLING Cast Steel Valve users!
1 Darling Fully Revolving Double Disc, Parallel Seat Gate Valve. Just four simple working parts . . . two interchangeable, no-pocket discs and two husky wedges. Maintenance is easier, assembly is foolproof, and tight seating is assured.
2 Darling Slotted Wedge Type Gate Valve. Notice the unique center slot which permits wedge to seat under compression and adjust to valve seats as valve body expands and contracts.

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WHETHER you select the fully revolving double disc, parallel seat type . . . or the slotted double grooved wedge type . . . you'll have a Darling gate valve with outstanding features that are minimizing down time and cutting maintenance costs on job after job.

Check cutaway view No. 1. This famous Darling self-adjusting, revolving disc parallel seat gate valve is rated by users as the most trouble-free, best performing gate valve obtainable. Its simple, efficient design assures *automatic* compensation for valve body distortion. In addition, wear on valve parts is *uniform*, which means much longer service life.

Now take a close look at cutaway view No. 2. This Darling valve will do everything that an ordinary solid wedge valve can do . . . *and more.* The wedge is slotted to assure better seating under valve body expansion and contraction. Tight closure and easy operation are assured, and there is far less wear on wedge faces and seats. *Also,* the *double* grooves, with *twin* guide ribs in the valve body, provide twice the usual bearing area. Canting of wedge caused by line pressure is thus eliminated, preventing damage to the downstream seat.

You'll be wise to get all the facts about these two types of money-saving Darling cast steel gate valves before you decide on any valve. Write today for general literature, or request information on your specific valve needs.

NOTE: Darling gate valves are made in a wide range of sizes, types and constructions for all kinds of normal and unusual service . . . and for pressures up to 1500 pounds.

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bulletins

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requirements, it contains piping for steam, condensate, water lines, fire lines, or process purposes all in place and insulated where required. Also included are traps, valves, and expansion devices. The literature explains how the system is installed and stresses the simplicity of making joint connections. The Ric-wil Co.

266—Pipeline Expansion

Catalog 135, 24 pages, is packed with engineering applications and selection data necessary to the proper solution of pipeline expansion problems. The center spread is devoted to a schematic piping layout illustrating various expansion joint applications and principles. Flexonics Corp.

PUMPS & COMPRESSORS

267—General Catalog

Equipment for buildings and institutions is the subject of 20-page bulletin WP-1099-B27M. Condensed information is provided on such equipment as air conditioning and refrigeration products; oil, gas, and dual fuel engines; deaerators and deaerating heaters; water conditioning; steam turbines and turbine generators; liquid meters; centrifugal pumps; regenerative turbine pumps; vertical turbine pump; and multi-V drives. Worthington Corp.

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268—Opposed Impeller Pump

How opposed impellers balance axial thrust is covered in 12-page brochure 1502. Sizes from 2 to 4 in., with 2 to 8 stages, are presented for capacities to 1000 gpm, pressures to 1200 psig, and temperatures to 350 F. Typical applications are tabulated. DeLaval Steam Turbine Co.

269—Screw Pumps

Bulletin S-205, 12-pages, is devoted to standard gear-in-head, high-pressure long-body gear-in-head, and standard vertical gear-in-head screw pumps. Basic construction and design are discussed in detail and there are sectional views with indicated features; also external and installation illustrations, dimensions, and specifications. Bulletin S-206 includes comparable information as applied to double external bearing and hopper types. Warren Steam Pump Company, Inc.

295—Controlled Volume Pumps

Design features and construction of motor-driven controlled volume pumps are detailed in 40-page booklet 53. Technical data include capacity adjustments, standard and special designs, and packaged systems. Describes typical applications in 6 major industries. Milton Roy Company.

REFRACTORIES

270—Refractories

Charts which show at a glance the properties of refractory castables, plastics and mortars are featured in 20-page catalog R-22. Important information including recommendations for each is presented. Photos depict application and end results. The Babcock & Wilcox Co., Refractories Div.

STEAM SPECIALTIES

271—Separators & Purifiers

Live steam, exhaust steam, air and gas, and receiver type separators, and steam purifiers and exhaust heads are described in 24-page catalog 500. Charts give pressure drop, steam capacity, and air capacity. Wright-Austin Co.

272—Steam Traps

Engineers concerned with steam traps should find 48-page catalog J a valuable source of data on recommended trapping practice. In addition to explanation of how to calculate condensate loads and select traps, a maintenance section covers installation, preventive maintenance, trouble shooting, and repair. Armstrong Machine Works.

273—Trap Selector

Handy, 20-page bulletin T1750 lists common industrial and process equipment and shows how to select proper size trap for each type. Tables show trap capacities, factors of safety, and pressure conditions. Installation recommendations are included. Yarnall-Waring Co.

296—Steam Accumulators

Balancing steam supply and demand with steam accumulators is the subject of 8-page bulletin RA-52-8. Typical installations, principles of operation, and advantages are discussed, and data are presented for calculating capacity. Foster Wheeler Corp.

297—Steam Gage Illuminators

Mercury vapor illuminators for steam gages are the subject of data sheet 196. Unmistakable water level indication is provided by a brilliant green spot at the water level. How it is installed on standard gages is discussed. Jerguson Gage & Valve Co.

298—Welded Floats

Units made of stainless steel, monel, and chrome plated steel, in spherical, eliptical, and cylindrical shapes are presented in 8-page bulletin 753. Sizes from 2 to 14 in. dia for pressures from vacuum to 4900 psi are listed with weights, buoyancies, and collapsing pressures. W. H. Nicholson & Co.

TOOLS

274—Tube Cleaners

Bulletin 43 introduces a new geared tube cleaner for removing scale in heat exchanger and condenser tubes of ⅜ to 2½ in. ID. The unit is said to be particularly effective where conditions require low speed and extreme power. The publication describes various types of drills available for use with this unit. Other features including a flushing system which insures a cool drill while removing scale. The Airetool Manufacturing Co.

299—Tube Cleaners

Equipment for practically every tube cleaning operation is presented in 28-page catalog Y-29. Specifications for cutter heads, drills, brushes, and motors are listed in illustrated tables for quick reference. Cutaways show design features of air, steam, water, and electric powered motors. Accessories are also presented. Sections on care and operation of tube cleaners and table of inside diameters for tubes and pipes add to the booklet's value. Elliott Co., Lagonda Div.

VALVES & REGULATORS

275—Regulating Valve

How control function of a pilot-operated valve can be changed by using a different sensitive pilot is explained in 4-page folder 700. A large cutaway illustration of the valve and a detailed description of design features are included. Spence Engineering Co., Inc.

It will pay you to look into Bird-Archer's 8 Point Water Treatment Service.

1 **PLANT SURVEY—Complete studies of your use of water or steam including equipment and past performance.**

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5 **FURNISHING PROPER CHEMICAL TREATMENTS WHEN REQUIRED—Bird-Archer custom formulates chemical treatments for your specific problems. Over 60 years background.**

6 **SPECIFICATION AND FURNISHING OF EQUIPMENT WHEN NECESSARY—Complete analysis of savings and benefits where additional equipment may be helpful.**

7 **PLANT STAFF INSTRUCTION—Your personnel instructed by experienced technicians in accurate control and test procedures.**

8 **PERIODIC CHECK-UPS—Your Bird-Archer Service Engineer makes regular personal call-backs on your plant to be sure you get the best possible results.**

FOR COUNSEL BACKED BY OVER SIXTY YEARS OF EXPERIENCE CALL BIRD-ARCHER'S QUALIFIED WATER TREATMENT ENGINEERS. CONSCIENTIOUS, PERSONAL ATTENTION AND HIGHEST QUALITY CHEMICALS.

Engineering Plus Chemistry Equal BIRD-ARCHER Service

Circle 553 on Reply Card for more data

bulletins

—Starts on page 96

276—Valves
The various types of valves made by this company are pictured by means of blue-print drawings, cross sections, and photographs in bulletins 500—505, 508, and 600. Complete dimensions are listed in tables. W. S. Rockwell Company.

277—Temperature Regulator
Bulletin 330 fully describes a simple, self-operating temperature regulator for plating, anodizing, bonderizing, pickling, cleaning, and rinsing solutions. The Powers Regulator Co.

300—Regulators
"How to Select Regulators," a 40-page booklet, provides useful data for simplifying the selection of pressure regulators, temperature regulators, or pump governors to do a specific job. Steam, gas, and water capacity tables, together with suggestions for installation and other pertinent information make this a useful reference. Foster Engineering Co.

278—Steam Traps
Balanced pressure thermostatic steam traps for pressures to 300 psi and capacities to 36,500 lb condensate per hr are discussed in 4-page folder 250-A. Construction details, operating principle, advantages and maintenance are discussed and illustrated with photos and cutaways. Screwed strainers are also briefly presented. Sarco Co., Inc.

279—Pump Valves
Pump valves and graphite packings are delineated in 24-page brochure SC-510. Types, details of construction, design features, applications, how to order, and dimensions are included. Heaters for heating water by blending with steam are also presented. Sims Pump Valve Co., Inc.

301—Cast Steel Valves
Booklet 12-C, 56 pages, contains information on material specifications, preparation of welding ends, flange facings, and pressure-temperature ratings. Construction and specifications for globe, angle, and check valves in 300, 600, 900, and 1500 lb pressure classes are given. Also discussed are parabolic disk valves for hand or motor control of volume. Edward Valves, Inc.

280—Flow Meters
Important data on the Diaflow Meter, for measuring air flow, gas flow, and the ratio between the two flows, are presented in eight-page booklet 52-1017-37. According to the booklet, the meter is particularly well suited for industrial furnaces and sewage disposal plants. The Hays Corporation.

WATER TREATMENT & WASTE DISPOSAL

281—Water Analysis
Published by a company engaged exclusively in the solution of industrial water conditioning problems, this 14-page brochure contains brief descriptions of testing and control equipment necessary for the more common water analyses. W. H. & L. D. Betz.

282—pH Control
"Automatic pH Control in Water and Industrial Waste Treatment," 8-page booklet, is a reissue of a paper delivered by R. T. Sheen, president of this company. Outlined are several typical systems of automatic pH control in boiler feed water treatment, using air- and motor-operated valves as well as controlled volume pumps to effect proper addition of chemicals. Diagrams of actual installations illustrate the bulletin. Milton Roy Co.

283—Water Clarification
Major advantages of the solids contact principle for clarifying and lime softening of water, and basic requirements for sound solids contact reactor design are incorporated in 24-page bulletin 5001-A. It illustrates the basic reactor types that can be supplied by this company—round or square units with vertical shaft agitator, and rectangular units with horizontal shaft agitator. Reactors can be made of concrete, steel, or wood or combinations of these materials. Chemical feed and auxiliary equipment are described. Cochrane Corp.

284—Water Purification
"Boiler Feedwater Treatment," 19-page bulletin BFT-1, covers Inversand zeolite softeners, cold process chemical softeners, and demineralizing units, including silica removal by ion-exchange. Each process is explained by means of chemical formulas and flow diagrams. Photographs and cross-sections of equipment are included. Hungerford & Terry, Inc.

TO REQUEST FREE BULLETINS
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W. S. ROCKWELL VALVES

Engineered for Dependable Service on Air, Gases, Liquids, Semi-Solids

FULL FLOW with minimum pressure drop.

ANY CONDITIONS of commercial, drip- or bubble-tight closure, with quick, positive control and shut-off manually or automatically.

RESISTANT Made ruggedly for all conditions of corrosion, erosion, temperatures to 2000° F., pressures to 300 p.s.i.

ALL TYPES Butterfly, wafer or slide valves, 1" to 120" pipe size.

W. S. ROCKWELL COMPANY

ROCKWELL SINCE 1888 BUILT

BUTTERFLY VALVES • SLIDE VALVES • AUTOMATIC VALVES

2304 ELIOT STREET • FAIRFIELD, CONN.

Sales Representatives in Principal Cities

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285—Ion Exchange Material
Strongly basic anion exchanger is presented in 16-page bulletin 57. Includes complete data on physical characteristics, exchange capacity and regeneration technique. Tables and graphs along with discussions explain performance under various operating conditions. National Aluminate Corp.

286—Water Treatment
Laboratory pictures in this 4-page folder show how Concentrol controls boiler water foam. Examples of its use in various industries are given along with an explanation of foaming. Bird-Archer Co.

287—Water Conditioning
Conditioning for boiler, process, and general applications is discussed in 20-page booklet 611A. A zeolite unit for manual and automatic operation is featured. In addition, chemical feed, zeolite-post treatment, zeolite-alkalinity neutralization, split-stream, and anion exchange dealkalization systems are explained. Elgin Softener Corp.

288—Water Sampling
Are you sure you know the which, when, and where of obtaining samples for proper control of water conditions in your power plant? "Effective Water Sampling," folder 28X7969, gives concise information on each phase of water sampling. Allis-Chalmers Manufacturing Co.

289—Waste Treatment
How this company has solved waste treatment problems for such industries as electro-plating, refinery, gas, and metal finishing is treated in detail in 6-page booklet 70-B. Cross-sections show the various types of chemical and biological treatment equipment. A handy bibliography serves as a reference for more information on waste treatment in each of the industries covered. Infilco, Inc.

P-D Dust Collectors and Fan Stacks Provide Maximum Flexibility and Unit Efficiency at Western Electric

sturdy, self-supported units... clean cut layout arrangements

It takes steam—lots of steam—to keep Western Electric's big Indianapolis plant turning out millions of telephones each year. During processing, sizable quantities of steam are needed and in addition over a million square feet of factory and office space must be heated.

The system that solves this problem is designed to deliver 187,000 lbs. per hour of steam, from three 60,000 lb. per hour steam generators and a 7,000 lb. per hour, incinerator boiler. The four units are equipped with an integrated arrangement of Prat-Daniel Dust Collectors, Induce Draft Fans, Breechings and Stacks. Small diameter tubes in the P-D Collector develop a high centrifugal force, providing maximum operating efficiency even at widely varying loads. The straight P-D Fan Stacks are of sturdy self-supporting construction. Flow through arrangement reduces resistance, providing more efficient draft production.

Engineered by Allen and Kelly of Indianapolis in collaboration with Western Electric's engineers,

SINGLE FAN TYPE TWIN FAN TYPE

Stacks and Dust Collectors were project engineered by The Thermix Corporation.

You too can have specialized help in solving your dust and draft problems. Call or write Thermix today.

Ask for the new P-D Catalog 4P201.

Project Engineers

THE THERMIX CORPORATION

GREENWICH, CONN.

(Offices in 38 Principal Cities)

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Designers and Manufacturers

PRAT-DANIEL CORPORATION

SOUTH NORWALK, CONN.

POWER DIVISION: Tubular Dust Collectors, Forced Draft Fans, Air Preheaters, Induced Draft Fans, Fan Stacks

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names make news

. . . personalities from industry and power

L. K. Sillcox

Election of **Lewis K. Sillcox,** honorary vice chairman of the **The New York Air Brake Co.,** as president of **The American Society of Mechanical Engineers** for 1954 is announced. Regional vice presidents elected are: **Willis F. Thompson,** v-p, Westcott & Mapes; **Prof. William G. McLean,** head of the Department of Mechanics, Lafayette College; **Thompson Chandler,** chemical engineer with Carbide & Carbon Chemical Corp.; **Vernon A. Peterson,** district mgr for Elliott Co.; and **Prof Clifford H. Shumaker,** director of the Institute of Management, Southern Methodist University. Elected directors-at-large are **Frank L. Bradley,** plant engineer, Forstmann Woolen Co., and **Robert B. Lea,** coordinator of exports, Sperry Corp.

Fred M. Winterhalter, engineer-in-charge of a-c design, electrical section, **Allis-Chalmers** Norwood Works, since 1949, is appointed chief engineer of the section with **Carroll F. Cobb** as assitant chief engineer.

Wayne F. Strong, elected vice president in charge of manufacturing for **Iron Fireman Manufacturing Company,** will head all production in the company's plants located in Cleveland, Portland, Oregon, and Toronto, Canada. **Robert V. Jack** succeeds Strong as manager of the company's Electronic Div.

The Okonite Company announces appointment of **Albert F. Metz** to the newly created post of chairman of the board and chief executive officer; **R. Stuart Keefer** as president; and **Edward D. Youmans** as vice president in charge of research and product development. Metz, Keefer, and Youmans were respectively president, v-p in charge of sales, and v-p in charge of manufacturing and research. **Charles M. Kirkland** will be v-p in charge of sales, and **David W. Nurse,** has been promoted to v-p in charge of manufacturing for the company's three factories.

Appointment of **K. A. Searles** as a technical service representative for the **Goodyear Tire & Rubber Company's** all-purpose adhesive. Pliobond is announced by **R. S. Earhart,** operating manager of the chemical division.

Coastal Engineering Corporation, engineering sales representatives in the New Orleans territory for **Graver Water Conditioning Company,** has been joined by **Davis E. Speeg,** who will serve manufacturers of industrial equipment.

W. A. MacDonald is elected executive vice president of the **Sterling Engine Company.** With Sterling since 1951, he previously served as v-p with Hupp Motors, Willys-Overland Company, and the Kaiser-Frazer Corp.

J. H. Devor, president of **Wagner Electric Corp.,** announces that Wagner has purchased a five-acre adjacent tract with buildings from the Fulton Iron Works Company. With this purchase, the company has acquired all of Fulton's land and buildings.

The **Benjamin F. Shaw Company** is celebrating its 60th anniversary with the addition of an Alloy Pipe Fabricating Plant according to **Benjamin F. Shaw, II,** president.

Joseph Pommersheim, a project engineer at **Rockwell Manufacturing Company's** Homewood plant, has been promoted to chief engineer of the company's Norwalk, Ohio, plant, it was announced today by **L. A. Dixon Jr.,** vice president, Meter and Valve Division.

Newly named superintendents in the service section of **Allis-Chalmers** general machinery division are **Nicolas J. Balazs** and **Willard H. Melton. Dudley B. Smith, Jr.,** has been appointed as a service engineer in the firm's midwest district.

Springfield Boiler Company will operate, with present management, as a division of the **John W. Hobbs Corp.** under a recent purchase agreement.

Promotion of **Felix W. Saco** to the newly created position of development engineer is announced by **The Permutit Company.**

Eastern regional sales manager of the **Darling Valve & Manufacturing Co.** is announced as **M. Stuart Evans. Joseph T. Cowan** is appointed district representative in the Tulsa, Oklahoma territory.

Victor Insulators, recently acquired by **I-T-E Circuit Breaker Company,** will continue to operate under its own corporate name as a subsidiary of I-T-E. **W. M. Scott, Jr.,** president of I-T-E, will become president of Victor, and **Edward A. Halbleib,** now its president, will become chairman of Victor's board of directors and shortly join the board of I-T-E.

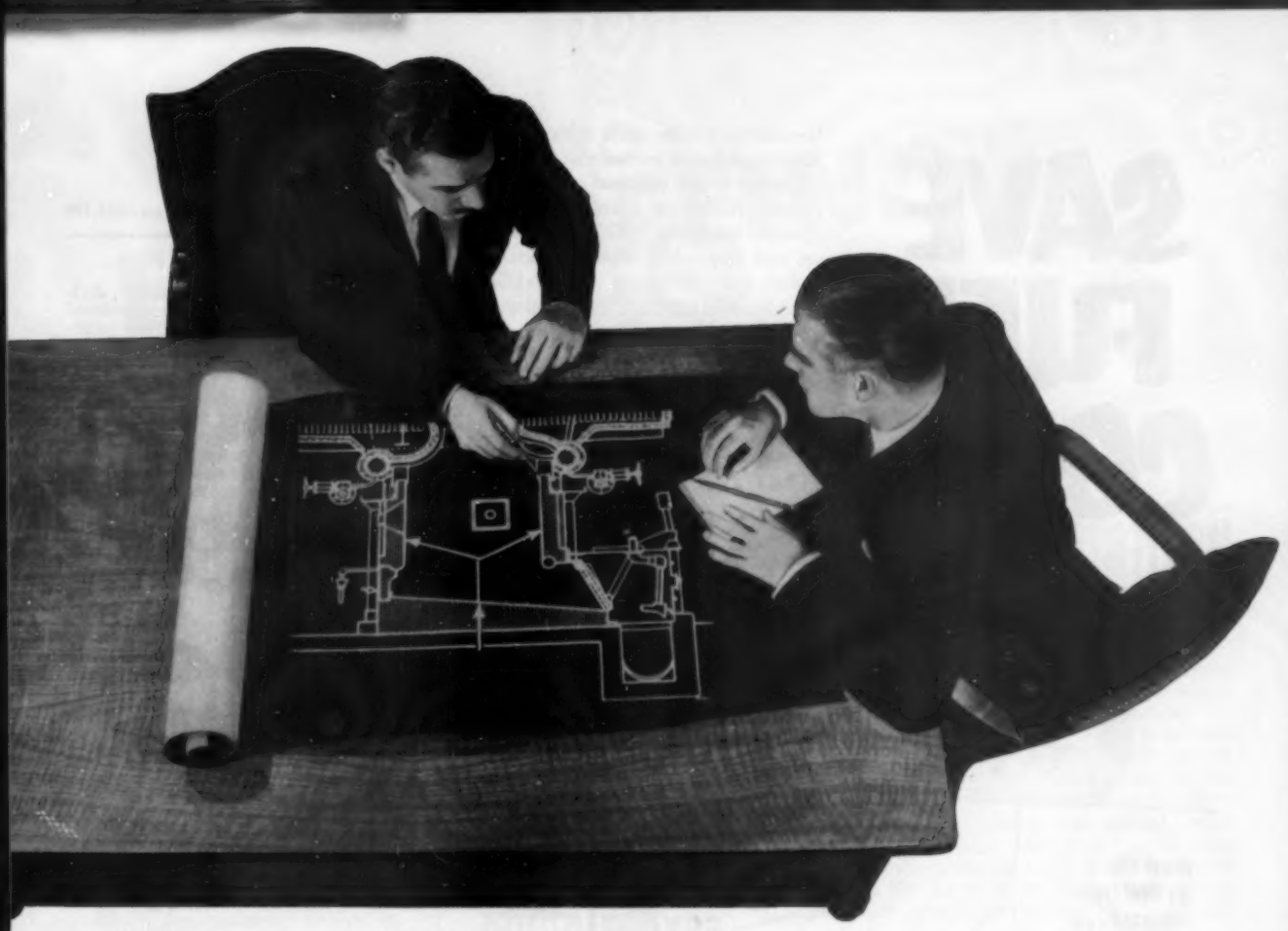
Promotion of three sales application engineers to new assignments encompassing broader responsibility in the **Reliance Electric & Engineering Company** is announced. **John Drollinger, Jr.,** becomes manager of the Renewal Parts and Repair Division in Cleveland; **William C. Mitchell** succeeds **Drollinger in Toledo; Robert O. Gee** becomes manager of service. In addition, **W. G. Hall,** who will continue to supervise the in-plant operations of Renewal Parts and Repair, is designated superintendent of the enlarged department.

Harold W. Sweatt, president of **Minneapolis-Honeywell Regulator Company** since 1934, was recently elected chairman of the board, succeeding **Mark C. Honeywell,** who was named honorary chairman. **Paul B. Wishart** succeeds Sweatt as president. New directors are **Tom McDonald** and **A. M. Wilson.** The five retiring officials include, in addition to Honeywell: **W. L. Huff,** director, executive v-p and former treasurer; **R. P. Brown,** v-p and chairman of the board of the Industrial Div. in Philadelphia; **George A. DuToit,** v-p in charge of manufacturing; and **L. Morton Morley,** v-p and formerly in charge of sales for the Industrial Div. Honeywell, Huff, and Brown will continue as directors.

The Trane Company announces the new location of the Oklahoma City, Okla. sales office at 819 North Virginia Street. **E. M. Jameson** is sales engineer in charge of the office.

David W. R. Morgan, vice-president and general manager of the **Westinghouse Electric Corporation's** South Philadelphia plant is appointed to the headquarters **staff of John K. Hodnette,** vice-president in charge of the

West German power plant engineers seen touring Worthington Corp.'s Harrison Works. Left to right: C. F. Hendrie, Worthington; Dr. J. Kingma, Berlin Power & Light Co.; K. Wust; H. Von Graberg, B P & L Co.; R. Erdman; Dr. W. E. Wellmann, B P & L Co.; J. G. Kuhnel, Berlin; Mrs. Wellmann; G. Navrotsky, Worthington; and K. Shultz, B P & L Co..



PROMINENT PUBLIC UTILITY

Cuts ashpit maintenance with B&W Refractory Concretes

A trial installation of B&W Refractory Castable "A", a 2600 degree refractory concrete, was made in one boiler ashpit. To date this castable has given 25 months more maintenance-free service than the refractories previously used.

Results of this first trial were so encouraging that another ashpit, shown in the drawing above, was lined with B&W Refractory Castable "A". In this installation the two opposing high velocity water sprays cut refractories life two ways. First, water splattered on the hot walls (about 1800F) caused spalling. Second, the high velocity water jets had an abrasive effect on the floor refractories.

Here's the report: "After 20½ months service, B&W's Castable "A" lining was still in excellent condition—far superior to the refractories used before."

On the basis of these trials three other boiler ashpits have been lined with this 2600 degree castable.

In addition to ashpit linings, B&W Refractory Castable "A" is widely used in boilers for baffles, hearths, door linings, special shapes, repairing eroded brickwork and forming pier walls in stoker-fired boilers.

B&W Castable "A" is only one of a line of B&W Refractory Concretes which cost-conscious furnace operators are putting to increasing use in hundreds of different applications. These B&W Concretes may help you cut installation costs and lengthen furnace life. Consult your B&W Field Engineer.

BABCOCK & WILCOX

THE BABCOCK & WILCOX CO.
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GENERAL OFFICES: 161 EAST 42nd ST., NEW YORK 17, N.Y.
WORKS: AUGUSTA, GA.

B&W REFRACTORIES PRODUCTS—B&W Allmul Firebrick • B&W 80 Firebrick • B&W Junior Firebrick • B&W Insulating Firebrick B&W Refractory Castables, Plastics and Mortars • OTHER B&W PRODUCTS—Stationary & Marine Boilers and Component Equipment . . . Chemical Recovery Units . . . Seamless & Welded Tubes . . . Pulverizers . . . Fuel Burning Equipment . . . Pressure Vessels . . . Alloy Castings

R-670A

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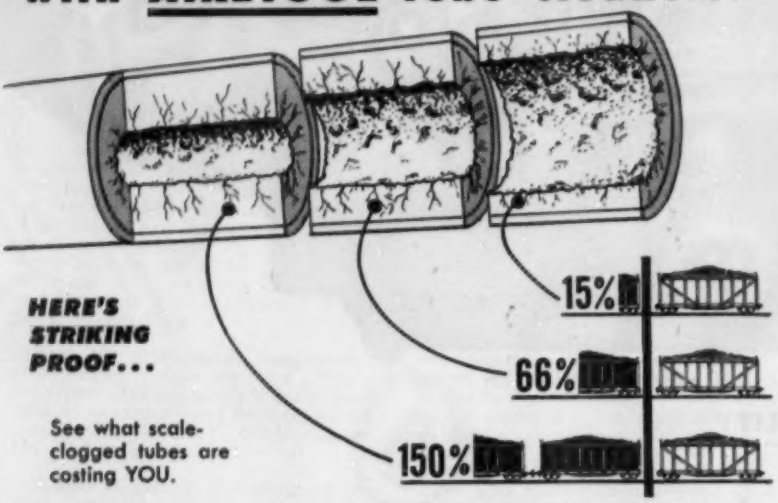
SAVE FUEL COSTS with AIRETOOL tube cleaners!

Remember — tube scale costs money! As scale deposits increase in thickness efficiency drops, and fuel costs mount rapidly. Keep your plant at peak efficiency — use AIRETOOL Tube Cleaners and Expanders when overhauling boilers and condensers. Powerful and flexible, AIRETOOL Tube Cleaners quickly and thoroughly remove deposits from both straight and curved tubes, keeping costly downtime at a minimum.

For information on how *you* can cut excessive fuel costs, write to The AIRETOOL Manufacturing Co., 318 S. Center St., Springfield, Ohio.



HERE'S STRIKING PROOF...

See what scale-clogged tubes are costing YOU.

1/16" thick scale deposit—15% additional fuel required!
1/4" thick scale deposit—66% additional fuel required!
1/2" thick scale deposit—150% additional fuel required!

There's an AIRETOOL Tube Cleaner and Tube Expander for every Type of Tubular Construction.

The forwardly swing arm type cleaner head is designed for efficient and rapid cleaning in tubes of short radius. For tubes of 2" to 5⅛" I.D.

AIRETOOL
MANUFACTURING COMPANY
SPRINGFIELD, OHIO

BRANCH OFFICES: New York, Philadelphia, Chicago, Tulsa, Baton Rouge, Houston, Hudson Heights, N. J.

Circle 557 on Reply Card for more data

names

— Starts on page 106

company's industrial products divisions. **Robert H. Wagner** is appointed general application engineering manager of the Westinghouse Elevator Division in Jersey City, N. J.

A. W. McKinney, executive vice president of The National Supply Co., has been reelected president of the **Diesel Engine Manufacturers' Association.** Other officers, also reelected, are: vice presidents—**Walter A. Rentschler,** vice president, Baldwin-Lima-Hamilton Corp., and **William E. Butts,** president, Enterprise Engine and Machinery Co.; treasurer — **Robert H. Morse, Jr,** president, Fairbanks, Morse & Co.; secretary — **Harvey T. Hill.**

McKinney **Christenson**

Re-elected president and chairman of the board of the **Industrial Mineral Fiber Institute, Inc.** is **Frank Christenson** of Refractory & Insulation Corp. **R. W. Capaul** of Glass Fibers Inc., was named vice president and **W. M. Ehrlich** of M. H. Detrick Company was re-appointed treasurer. Directors for the coming year are **R. W. Capaul, G. J. Christner** of The Eagle-Picher Sales Company, **D. A. Rosensteele** of the National Gypsum Company, and **E. R. Stevens** of Baldwin-Hill Company.

For the Texas and Gulf Coast area, **Edward Valves, Inc.,** announces the appointment of **Rex E. Galloup** as district manager. He was formerly sales manager for the Oil Center Tool Company.

The year 1954 marks celebration of the golden anniversary of the **Pangborn Corporation. Thomas W. Pangborn,** president, sold his first sand blast machine in New York City in 1904.

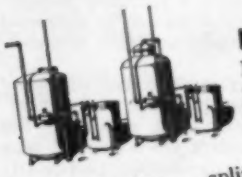
Appointment of **H. J. Feichtmann,** as district manager Heavy Machinery Div., north central territory for **Nordberg Manufacturing Company** is announced. He succeeds **E. C. Brooks,** former district manager now retired.

Charles B. Elledge of **General Electric Company** is elected president of **The Material Handling Institute, Inc.,** for 1954. **Walter E. Schirmer,** vice president of Clark Equipment Company and **Edward W. McCaul,** secretary of Jervis B. Webb Company, were selected first and second vice presidents, respectively. Elledge succeeds **Howard M. Palmer** of Lewis-Shepard Products, Inc., who will now become a director of the association.

ELGIN-REFINITE

Just a hyphen, but it marks...

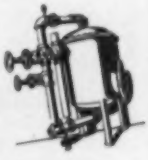
...today's greatest advance in Water Conditioning



Ion Exchange Equipment

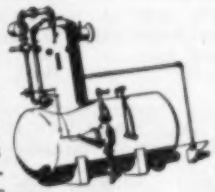
From sodium zeolite to complete deionization and silica removal, the Elgin-Refinite line is complete: The famous "Double-Check" zeolite softener . . . zeolite-alkalinity neutralization . . . split stream sodium and hydrogen zeolite softening with degasification . . . the Ultra-DeIonizer providing distilled water quality at a fraction of the cost.

Filtration in all phases



Diatomite filters . . . sand filters . . . activated carbon filters . . . anthrafilt filters for every use ranging from municipal water works and swimming pools to oil removal and many other applications.

Aeration, Degasification, and Deaeration



All types of equipment for removal of dissolved and entrained gases from water through degasification and aeration. A big efficiency gain is made by deaerating heaters which supply make-up water, preheated by exhaust steam, in which carbon dioxide is eliminated and oxygen is reduced to less than 0.005 cc per liter.

Lime-Soda, Coagulation, and Clarification

Whether it's simple clarification, cold lime soda or hot lime soda, Elgin-Refinite has the efficient answer. Hot lime followed by zeolite eliminates excess chemical dosage or after-treatment regardless of operating variations. Packaged and specially engineered equipment.

No other plant operating problem involves quite so many ifs, ands, and buts as water conditioning. Because raw waters are so varied—because "finished" water needs are equally varied—the water conditioning methods that are a howling success in one plant can be a dismal failure in another.

Too many operating men have learned this the hard way; and that is why your water conditioning problem should be placed only in the hands of an organization that measures up to these two vital requirements:

1. Maximum experience with *all* waters and *all* water requirements.
2. Not only good equipment, but *all types* of good equipment and methods from which an unprejudiced selection can be made to meet your specific water conditioning needs.

These difficult requirements were fulfilled as never before when Elgin and Refinite joined forces in October 1953. Each organization had a wide line of equipment; but together their scope is unlimited. Each was old established; but together they represent 83 years of intensive experience.

It is impossible to show in limited space the unequalled range of Elgin-Refinite services. But note that we do briefly outline opposite how much more Elgin-Refinite has to offer in the four basic categories of water conditioning. This combined experience and scope is your assurance that your water conditioning problem will be solved in the most versatile, dependable, economical way by Elgin-Refinite!

ELGIN-REFINITE
Division of Elgin Softener Corp., 131 N. Grove Ave.,
ELGIN, ILLINOIS
Representatives in principal cities

Elgin REFINITE SINCE 1905

In Canada:
G. F. Sterne & Sons
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New and up-to-date

POWER PLANT ENGINEERING

The Theory and Practice of Stationary Electric Generating Plants

by Frederick T. Morse, Professor of Mechanical Engineering, University of Virginia

687 pp., illus., $8.75

MUCH MORE than merely a third edition of the author's predecessor book, this revision puts greater emphasis on the small and medium sized plant while continuing a thorough study of stationary power and heating plants, including public service, industrial and institutional varieties.

THERE IS NEW material on gas turbines, the fundamentals of nuclear energy, boilers, turbines, and condensers. Problems of the operating engineer, including tests and identifying sources of difficulties, are more thoroughly covered and throughout the book engineering principles of power plants and their operations, as well as design, are featured. Every consulting engineer and plant operator will find this treatment of the recent trends and theories in the field of power generation invaluable.

Contents by Chapter Headings

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INDUSTRY AND POWER

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. . . of special interest

POWER PLANT ENGINEERING, by Frederick T. Morse, D. Van Nostrand Company, Inc., $8.75.

Power plant engineers and consultants in the power field will be interested in the recent publication of the Third Edition of a volume which has become, during the past fifteen years, one of the standard texts and reference books dealing with the theory and practice of stationary electric generating plants. Many practicing engineers used *Power Plant Engineering and Design* as their college text and have used it in their work during the succeeding years.

Not only has the title been changed, but the whole volume has been rewritten and rearranged to fit it to current engineering needs. The old chapters on hydraulic power and electrical equipment have been deleted as unsuited to the text, but the section on steam plant equipment has been greatly expanded, and a new chapter has been added on the gas turbine. The objective continues to be the presentation of a useful study of stationary power and heating plants including public service, industrial, and institutional installations.

While, on the one hand, the book may be said to try to cover too much subject matter to do a thorough job (any one of the chapters, Power Plant Building Materials, Fuels and Combustion, or Vapor Cycles, for example, could be expanded into several volumes without danger of becoming definitive) its value is perhaps increased by this very scheme. It is obviously handy and time saving to have so much coverage in one volume, and the reader needing more material on specific subjects can easily refer to other more specialized texts.

ALSO AVAILABLE

HANDBOOK OF NOISE MEASUREMENT; Arnold P. G. Peterson and Leo L. Beranek; General Radio Company; 120 pages, including 18 page catalog section. This new publication replaces the familiar General Radio *Noise Primer;* it covers thoroughly the measurement of airborne sounds, including definitions, standards, measuring equipment, procedures, and interpretation of results.

RECOMMENDED PRACTICE FOR SUPPLEMENTARY LIGHTING; Illuminating Engineering Society, 16 pages, 50¢. This publication is to be used with the recently released *Industrial Lighting Standard.* The new report provides additional information for supplementary lighting for critical seeing tasks. It was prepared by the I.E.S. Subcommittee on Supplementary Lighting to give the answers to many extraordinary lighting problems.

The new recommended practice is concerned primarily with lighting which supplements general illumination in manufacturing processes. The booklet is extremely well illustrated, having many apt photographs ideally pointing out the recommendations for each class of lighting difficulty.

"BETZ HANDBOOK OF INDUSTRIAL WATER CONDITIONING," 4th Edition, W. H. & L. D. Betz, 248 pages, $3.00. Although this book is basically a technical publication, the subject matter is presented in a direct, simple, and easy to understand form.

Introductory chapters deal with basic water treatment processes such as aeration, coagulation, and softening. The following chapters are concerned with specific water problems, particularly those in boiler water and cooling water conditioning. Applications and limitations of various equipment and methods are covered in detail.

To guide plant engineers in handling and supervising such operations, a supplementary section is devoted to control water analyses and their interpretation.

REVISIONS OF AMERICAN STANDARDS on transformers, regulators and reactors may be obtained from American Standards Association, Inc., 70 East 45 Street, New York 17, N. Y. at the following prices:

C57.10-1953 American Standard Terminology for Transformers, Regulators and Reactors. Gratis.

C57.11-1953 American Standard General Requirements for Transformers, Regulators and Reactors. Gratis.

C57.13-1953 American Standard Requirements for Instrument Transformers and Table of Contents. $1.00.

C57.33-1953 American Standard Guide for Loading and Operation of Instrument Transformers. $.35.

NATIONAL ELECTRICAL CODE, 1953 Edition, National Fire Protection Association, cloth bound $3.00; paper bound $1.00. The most widely used safety standard of its kind, the National Electrical Code forms the basis for safe electrical appliances and electrical installations in buildings. The 1953 code has been adopted by the American Standards Association. A number of

revisions have been included in the new edition.

STANDARDS ON CAST IRON PIPE AND FITTINGS may be obtained from the American Standards Association, 70 East 45 Street, New York 17, N. Y. at the following prices: Cast Iron Pit Cast Pipe for Water or Other Liquids (Revision of A21.2-1939), A21.2-1953. $.45.

Cast Iron Pit Cast Pipe for Gas, A21.3-1953. $25.

Cement Mortar Lining for Cast Iron Pipe and Fittings (Revision of A21.4-1939, A21.4-1953). $.35.

Cast Iron Pipe Centrifugally Cast in Metal Molds, for Water or Other Liquids, A21.6-1953. $.40.

Cast Iron Pipe Centrifugally Cast in Metal Molds, for Gas A21.7-1953. $.25.

Cast Iron Pipe Centrifugally Cast In Sand-Lined Molds, for Water or Other Liquids, A21.8-1953. $.45.

Cast Iron Pipe Centrifugally Cast in Sand-Lined Molds, for Gas, A21.9-1953. $.25.

Short Body Cast-Iron Fittings, 3 inch to 12 inch, for 250-psi, Water Pressure Plus Water Hammer, A21.10-1952. $.35.

A Mechanical Joint for Cast-Iron Pressure Pipe and Fittings, A21.11-1953. $.35.

INDUSTRIAL FILMS

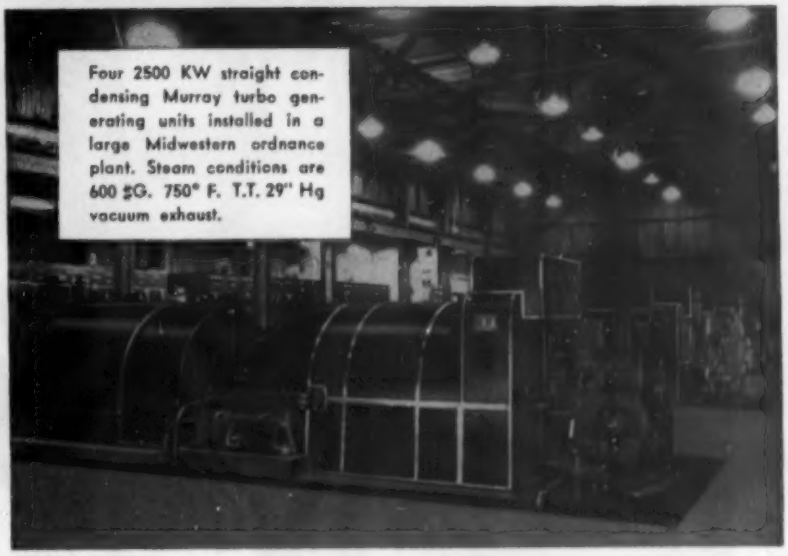
"ELECTRIC WIRING WITH ALCOA ALUMINUM," Aluminum Company of America, Motion Pictures Division, 818 Alcoa Bldg., Pittsburgh 19, Pa. Originally prepared for electricians working on the erection of Alcoa's new Pittsburgh office building, this film deals almost entirely with techniques of handling and joining in installing aluminum conduit, cable, and wire. The compounds used and the preparation methods for joining wire and cable are fully explained. Accompanying the film is a booklet entitled "Electrical Wiring With Alcoa Aluminum."

"A Is for Atom," sound and color. General Electric Co., Schenectady 5, N. Y. An expanded 16-minute version now offered to business and industry, of the 10-minute film being shown in movie houses throughout the country. Copies loaned by G-E district offices, or sold at $100 per print.

"SELECTED MOTION PICTURES," is a list of 16 mm sound motion pictures available through Associated Films. Films are grouped under 22 category headings. This is said to be the largest selection of industrial films available from one source.

For copies of this listing write: Association Films, 347 Madison Avenue, New York 17, New York.

Murray Turbines



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Consult your local Murray representative who will gladly help you select the unit most economically suited to your conditions.

MURRAY IRON WORKS COMPANY
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"HI-TEMP"
C-5 THREAD COMPOUND
IS BEST FOR ALL STUD THREADS and STAINLESS STEEL APPLICATIONS

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✓ prevents stud breakage
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NO MORE FROZEN OR GALLED STUDS EVEN AT 1800°F

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To assure easy maintenance on products having threaded assemblies many leading product engineers have specified the use of Fel-Pro C-5 as an anti-seize coating on stud threads prior to final production line assembly.

Fel-Pro's exclusive Colloidal-Copper formula allows for easy separation and reduces stud breakage of threaded assemblies after long exposure to extreme temperatures. It eliminates pitting of stainless and alloy steel even where dissimilar metals are joined.

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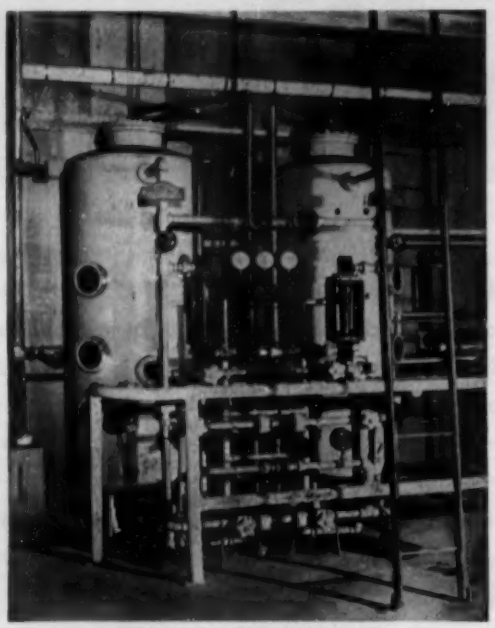

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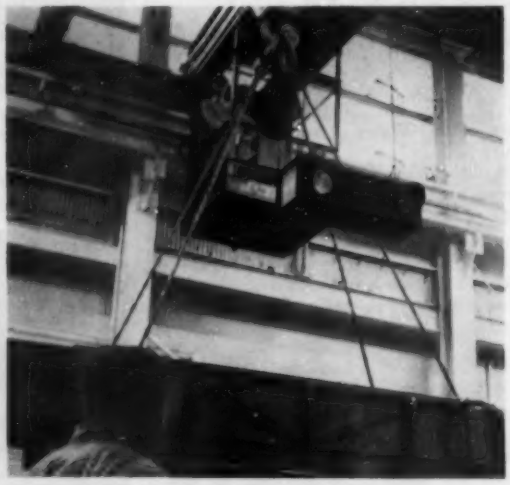
to reach across the width of the crate. A metal ring at the center of this chain connects to a long chain that is anchored on the lift truck.

After attaching the corner plates and anchoring the long chain on the lift truck, the operator tilts his fork lift until the slack harness is drawn taut. Plate points bite into the crate, the far end of the crate leaves the ground, and the load is ready to move.

On TEMCO's docks, the harness has reduced large crate moving from a two and three-man operation to a one-man job.



Traffic Lights in Craneway Protect Employees

Red traffic lights—similar to the type used at railway crossings—flash a warning whenever the overhead crane at the Standard Pressed Steel Company plant approaches any one of three heavily traveled cross-aisles.

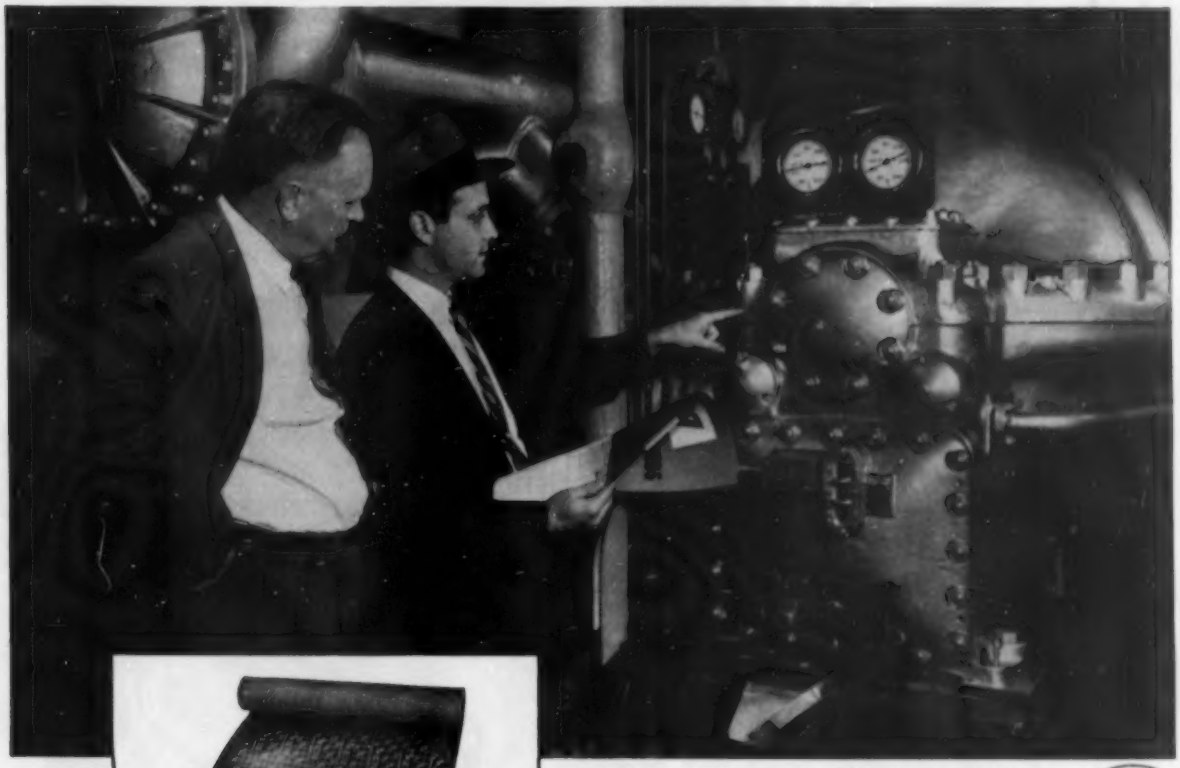
The lights are automatically flashed on by photo-electric eye when the overhead crane comes within 20 ft of an aisle. In all, three such units protect the heavy traffic that flows over the three cross aisles in the 335-ft crane bay. Cost of this simple, but effective home-made safety device is only $250 per aisle—the cost of the photocell unit, traffic light, and necessary controls and wiring.

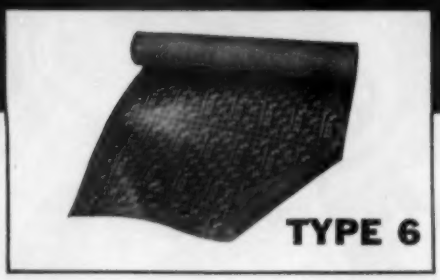
Battery Need Calculator Developed for Electric Trucks

A simple, direct, and time-saving method for determining the size battery required for any electric industrial truck installation has been developed by the Automatic Transportation Company.

Three simplified charts are used: one for travel cur-

R/M's BIG 7 Packing Types meet 95% of all packing needs





Centrifugal compressors like this one, which is used to air-condition a huge office building, give top performance with R/M Packing No. K-68, a gasket material included in Type 6 of R/M's "Big 7" Packing Types.

Let R/M lower your packing inventory

If you are under the impression that you must stock 10, 20, 50 different types of packings, get acquainted with the distributor who sells R/M's "Big 7" Packing Types. R/M's "Big 7" Packing Types have so simplified the whole packing picture that your plant can probably standardize on just three or four. This basic line of just seven field-tested packing types is engineered to give custom-built performance in all but the very rarest packing applications. It can reduce your downtime, cut your maintenance costs, simplify your ordering. Call in your R/M distributor today.

R/M PACKINGS FOR MAINTENANCE PURPOSES ARE SOLD ONLY THROUGH AUTHORIZED R/M DISTRIBUTORS

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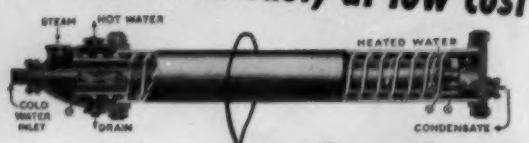

In the Johnson Heater, water to be heated is routed first inside, then outside, a blanket of live steam. It's full pressure steam, too; up to 150 lbs., or 250 lbs. in heavy duty types, no reducers are needed. The result: faster, more efficient heat transfer for a unit of its size. No wonder industry has found so many applications for the Johnson "Instant" Heater, in heating water and process liquids of various types.

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Sizes for all needs; write for literature

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LIQUIDOMETER Tank Gauge

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spot news

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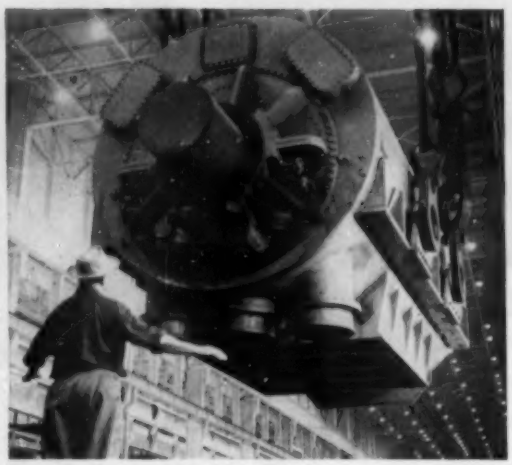
rent, one for lift and tilt current, and one for ramp current. Although based on the efficiency of Automatic trucks, the charts can be applied successfully to most electric industrial trucks.

To use the charts, the following factors must be determined first: (1) weight of truck, (2) average weight of load handled, (3) average length of trip one way in feet, including ramps, (4) elevation in feet of any ramps in the trip, (5) number of trips desired per hour, (6) average lifting height, (7) number of lifts per hour, and (8) conditions which might require constant acceleration.

Copies of the complete "Truck Battery Calculator Charts" are available from the company, 149 W. 87th St., Chicago.



Inner-Cooled Generator Is Smaller and Lighter-Weight

Powerful enough to light a city the size of Nashville, Tennessee, this completely inner-cooled generator, rated at 100,000 kw, is only slightly larger in size than the average 40,000 kw unit and 15,000 lbs lighter than the average 100,000 kw unit.

The key to the increase in power rating, while the physical size is reduced, lies in the Westinghouse-developed cooling system for large turbine generators. This system is designed in such a way that the cooling

CITY WITHOUT COAL

Without coal a great modern city is a helpless cripple. Heat. Lights. Refrigeration. Transportation. Elevators. Signal systems. Telephone. Industry. All these depend on coal.

One modern city came near such paralysis. That was Berlin in 1948 when the Russians thought to strangle it into submission. Of all the cargo flown into Berlin, 64% was coal. Nearly 1,500,000 tons. Enough to fill 30,000 big, hopper coal cars. That coal was like new blood in a dying man's veins.

We don't fly much coal here in America—occasionally to an arctic defense base or a bag dropped to a storm-isolated farm house. Coal is something we have always taken for granted. There's plenty to last a thousand—maybe two thousand years. It is widely distributed; and the great coal-hauling railroads like the C&O are equipped to move it rapidly.

For instance, the C&O has invested many millions of dollars in great coal-handling docks at Newport News and Toledo to facilitate water shipments to Atlantic and Great Lake ports.

Coal is one natural resource you don't need to worry about. It is the one fuel that will always be plentiful.

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COAL...FUEL OF THE FUTURE

Bring your fuel problems to C & O

As the world's largest carrier of bituminous coal, the C&O is intimately familiar with every phase of coal use. We have a large staff of experts who will gladly help you to locate the coal best suited to your needs; to help you use it most efficiently; to help get it to you most economically.

Write to:
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Chesapeake and Ohio Railway
2110 Terminal Tower
Cleveland 1, Ohio

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POWERS Controlled

In the Most Efficient REA Plant of the Wolverine Electric Cooperative, winner of the 1952 Award for economical operation, Powers Air Operated controls were used to maintain Lube Oil and Jacket water at the right temperature.

Powers Controls shown at left have been thoroughly time tested and proven reliable on many large engine installations.

For Large or Small Air Compressors, Gas or Diesel Engines Powers has the right control that will insure the right temperature at all times regardless of variations in load or seasonal changes in temperature of water supply. Write for Bulletin RDIG. (b52)

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Over 60 Years of Automatic Temperature and Humidity Control

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How you can get longer pump-valve life

SIMS PUMP VALVES HAVE FOUR FEATURES THAT GUARANTEE LONGER LIFE

1 Double shock absorber stem heads—eliminate stem breakage.

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3 Rotating valve disc—wears slowly, evenly; can't pound up and down on same spot.

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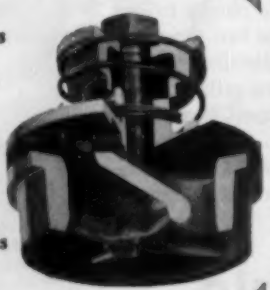
Complete stocks on hand. • Used by blue chip companies throughout the U.S. • Ask for Bulletin IP-2 or a report on what these valves can do for you—no obligation.



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PUMP VALVE CO., INC.

1314 PARK AVENUE, HOBOKEN, N. J.

M&M BLDG., HOUSTON, TEXAS

SP-108

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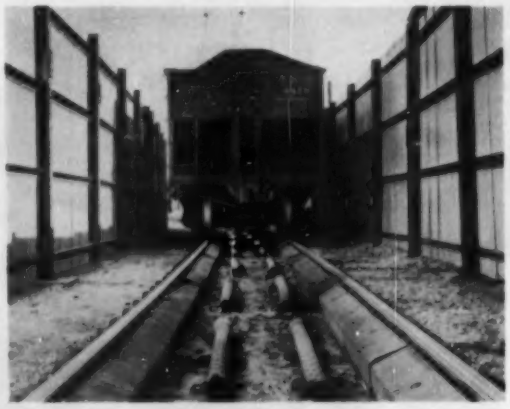
agent hydrogen gas, comes in intimate contact with not only the copper coils of the stator, but also with the bare copper of the coils in the rotating part of the generator. After carrying the heat away for disposal, the hydrogen had been able to pick up only the limited amount of heat that seeped through the insulating jacket covering the copper and steel.

The unit is being installed at Buffalo, New York by the Niagara Mohawk Power Corporation.



Jet Heaters Thaw Coal in Car Hoppers

Jet heaters encased in short lengths of perforated four-inch wrought iron pipe are used to thaw coal in railroad cars at the Norfolk and Western Railway Co., Lamberts Point, Va.

A development of the railway company's engineering department, the device helps to melt ice formations that otherwise keep coal frozen in the hopper and prevent prompt and efficient unloading operations.

A. M. Byers Company's corrosion resistant wrought iron pipe was specified because of its ability to withstand intense heat and exposure to air.

Sintered Nylon Bearings Resist Vibration Wear

Bushings made from low friction sintered nylon have shown an unusual resistance to wear from vibration and oscillation in large electric motors and generators, according to a manufacturer of electrical and power equipment, who adapted the bushings to brush holders in some large horsepower motors.

These bushings fit around the steel pin that holds the assembly together. In operation, the carbon brushes held in the brush holder assembly wear against a rotating copper commutator. This produces an oscillating action and a high velocity vibration which, in turn, causes impingement on the bearings.

The powdered metal bearings formerly used wore quickly under these conditions. As a result, the as-

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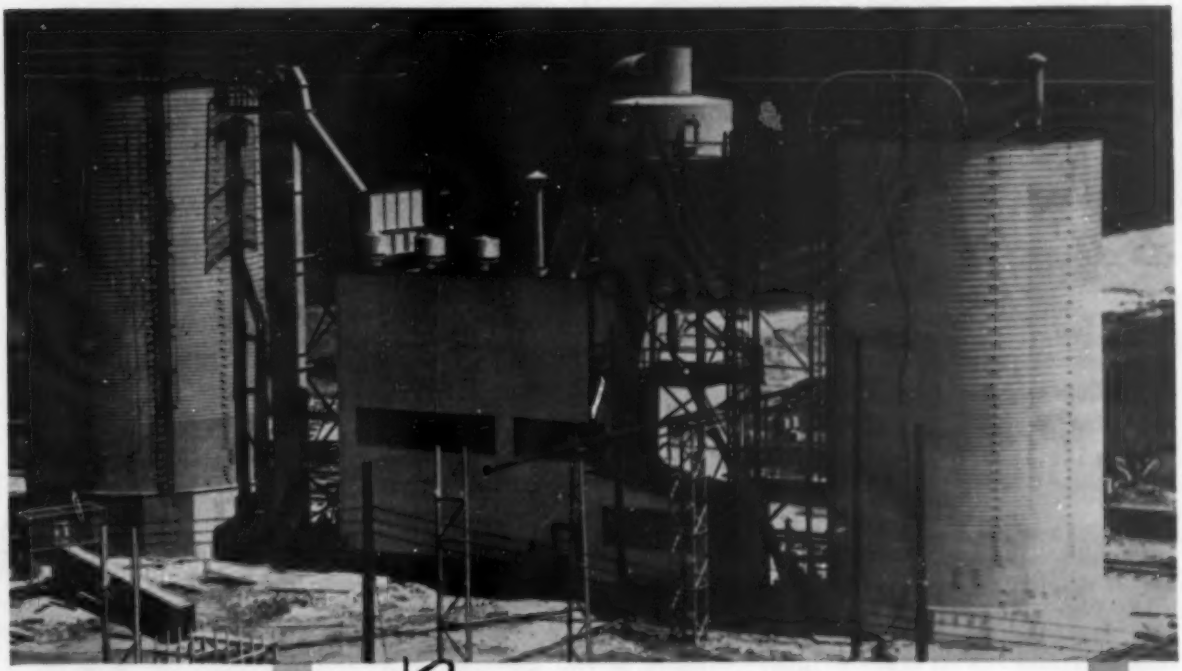
MARIETTA Concrete Silos and Storage Systems are designed to meet the specific needs of diversified industries. A permanent MARIETTA storage system, although geared for the future with built-in design flexibility, is capable of meeting industry's ever-increasing demands.

MARIETTA gives you large capacity storage for efficient, economical materials-handling and eliminates the need for drawing from ground storage.

There is no limit to the equipment that can be incorporated into a MARIETTA silo wall, floor or roof. Design flexibility is a fundamental feature purposely engineered into all MARIETTA Silos to provide for any efficient discharge or servicing system.

To improve handling facilities, help build reserves, lower your operating costs and keep pace with increasing demands . . . write MARIETTA for complete information. Catalog available upon request.



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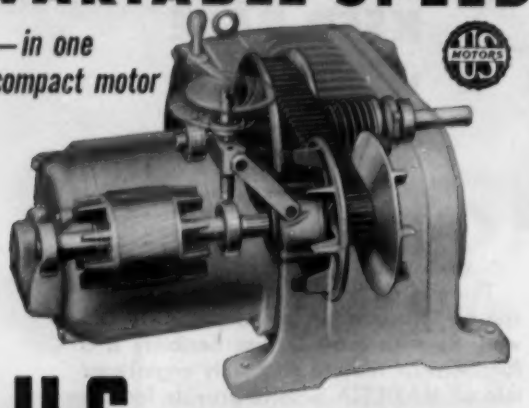
VARIABLE SPEED
—in one compact motor



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Longer Service Life — Ric-wiL systems are factory prefabricated on precision machines — all operations are carefully controlled eliminating chances for faulty workmanship to cause service failure.

Whether your problem involves underground or overhead piping — extreme temperatures or corrosive products — if proven insulated piping systems are required . . . it will pay you to call in your Ric-wiL representative as early as possible in your planning.

Ric-wiL PREFABRICATED INSULATED PIPING

UNDERGROUND OR OVERHEAD

THE RIC-WIL COMPANY • BARBERTON, OHIO

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—Starts on page 88

sembly had to be repaired or replaced frequently. But since the bushings have been made of cold pressed and sintered nylon, the vibration has had no ill effect. These nylon bushings have been found to give not only a high degree of resistance to wear, but also total freedom from lubrication needs. The wear surfaces needed only a few "break-in" drops of oil at the time of installation.

The twin bushings in this application were made from a finely divided nylon powder called Nylasint Molding Powder, Type 66, made by The Polymer Corp. and sold by National Polymer Products, Inc.

Crane on Roof Hoists and Sets Structural Steel

Working from wooden mats spanning the framework on the roof of a boiler building, a Lorain TL crane, hoisted and set structural steel from a point 140 ft above ground. Owned by the Hart Construction Company of Omaha, Nebraska, it also was used to assist in the boiler assembly. The Thew Shovel Company crane was raised in two sections to the top of the building by a "stiff leg" crane.

The building, shown under construction, will house a 110-ft-high, 575,000 lb-per-hr capacity boiler. For use at the new $17 million North Omaha Plant of the Omaha Public Power District, the boiler, made by Combustion Engineering Corporation, is capable of operating a 75,000-kw generator.

Transition Piece Eliminates Need for Butt Weld

For use in England on ultra high-temperature, high-pressure steam systems, bi-metallic Kelcaloy transition pieces, made by the M. W. Kellogg Co., will be used to connect ferritic throttle valves with austenitic steel main steam piping.

In England the design practice is the reverse of that used in this country. Chrome-moly is used for the valve and hook-up to the steam chest, while stainless steel, because it may be designed for thinner walls,

is used for increased flexibility in the main steam piping.

The basic reason for the use of transition pieces lies in designers' reluctance to join by a butt weld two metals of widely varying thermal coefficients of expansion. The transition piece eliminates the need for welding these different materials together. In the Kelcaloy process austenitic steel is integrally bonded to a ferritic chrome-moly forging to provide a transition piece which is of the desired chrome-moly steel at one end, and austenitic stainless at the other, and having a central transition bond of controlled axial length.

First use of such pieces was made by the Public Service Electric and Gas Co. on four units in its Sewaren Station, which operates at 1050 F and 1500 psig. The main steam piping at Hudson Avenue Station Annex of Consolidated Edison Co. of New York, operating under similar conditions, is also equipped with Kelcaloy transition pieces. In both these instances, they were used to connect chrome-moly main steam piping with stainless steel throttle valves, contrary to the British practice.

Motors Are Designed to Operate Through Power Interruption

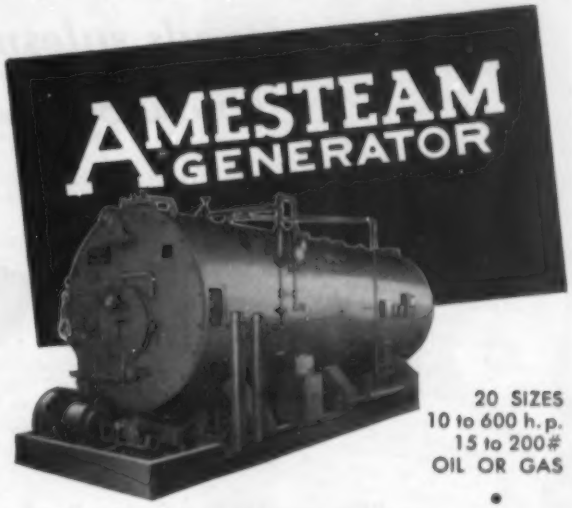
To power pumps which must continue to run even through momentary interruption of power, Westinghouse Electric Corporation produced 12 specially-designed, vertical squirrel-cage induction motors. Each motor is rated 900 hp, at 585 rpm, and has a built-in seven-foot diameter flywheel. With an energy storage of 4,260,000 lb. ft, the flywheel will maintain the pump above half speed for a 15-sec power interruption.

HEATING SYSTEM REDUCES DRAFTS

Measuring ten feet in length, this variable heater section built by L. J. Wing Manufacturing Co. will be used to assure a supply of tempered fresh air at one of the country's vital defense projects. Temperature control is achieved by blending many alternate streams of heated and unheated air. This system of heating is said to reduce drafts caused by lowered air pressures within the plant.

REAL SAVINGS

in installation . . . in operation with these "PACKAGED" BOILERS



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10 to 600 h.p.
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OIL OR GAS

JUST SET IT ON YOUR CONCRETE FLOOR — no special foundation or heavy stack are needed. You make BIG savings on installation of AMESTEAM GENERATOR because it's a complete, self-contained unit, ready to start generating steam!

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COMPLETE SERVICE! Our LOCAL service man starts your unit and gives you three months' FREE service.

Write for FREE bulletin TODAY!

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"Every one of us at Republic Steel is proud of the results of our Payroll Savings campaign: 96.7 per cent of our employees saving systematically from each pay in U. S. Savings Bonds. These results were possible only because all 68,344 of us at Republic were part of an enthusiastic team. We feel that this is the best way we can demonstrate our appreciation of the efforts to have a sound dollar and a stable economy."

• 96.7% of Republic Steel's 68,344 employees—over 66,000 men and women—are enrolled in the Payroll Savings Plan.

• These 66,000 members of Republic's "enthusiastic team," as Mr. White so aptly terms them, are investing more than $16,000,000 per year in U. S. Savings Bonds.

• In addition to building personal security, these men and women of Republic are making a very important contribution to America's "efforts to have a sound dollar and a stable economy."

Certainly Republic Steel's Payroll Savings record is outstanding—one of the best in the country. But it is not unique. Other companies have comparable records, measured in percentage of employee participation, or in annual Savings Bond purchases.

In every company with a high percentage Payroll Savings Plan you will find that the president or top executive appreciates the importance of the Plan and what it means to personal and national security. He knows that 45,000 companies have Payroll Savings Plans . . . that 8,000,000 employees of these companies are investing more than $160,000,000 per month in Savings Bonds . . . that the cash value of Savings Bonds held by individuals today is more than 36 billion dollars—and rapidly mounting, thanks largely to the steadily increasing family of Payroll Savers. He is 100% behind his company's Payroll Savings Plan, and everybody in the company knows it. He takes personal pride in watching employee participation grow to 60%, 70%, 80%, or, perhaps, the high 90's.

If you are not making this important contribution to America's effort for a sound dollar and a stable economy, a wire or letter to Savings Bonds Division, U. S. Treasury Department, Washington, D. C., will bring prompt cooperation from your State Director. He will show you how easy it is to join Mr. White and thousands of other executives as a Savings Bond Salesman for Uncle Sam, with a company Payroll Savings Plan that you can be proud of.

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meetings

. . . and exhibitions

Jan. 17-19	Institute of Scrap Iron and Steel (Annual Convention)	Statler Hotel Washington, D. C.
Jan. 18-22	American Institute of Electrical Engineers (Winter General Meeting)	Statler Hotel New York, N. Y.
Jan. 25-27	American Society of Heating and Ventilating Engineers (60th Annual Meeting)	Rice Hotel Houston, Texas
Jan. 25-28	Plant Maintenance and Engineering Conference (Exposition)	Conrad Hilton Hotel Chicago, Ill.
Feb. 4	Instrument Society of America (9th Annual Regional Conference)	Statler Hotel New York, N. Y.
Feb. 11-12	Western Computer Conference and Exhibit (2nd Annual Meeting)	Ambassador Hotel Los Angeles, Calif.
March 15-19	National Association of Corrosion Engineers (10th Annual Conferences)	Muehlebach Hotel Kansas City, Mo.
April 1-3	Electrical Maintenance Engineers Association of Southern California (Industry Show)	Shrine Hall Los Angeles

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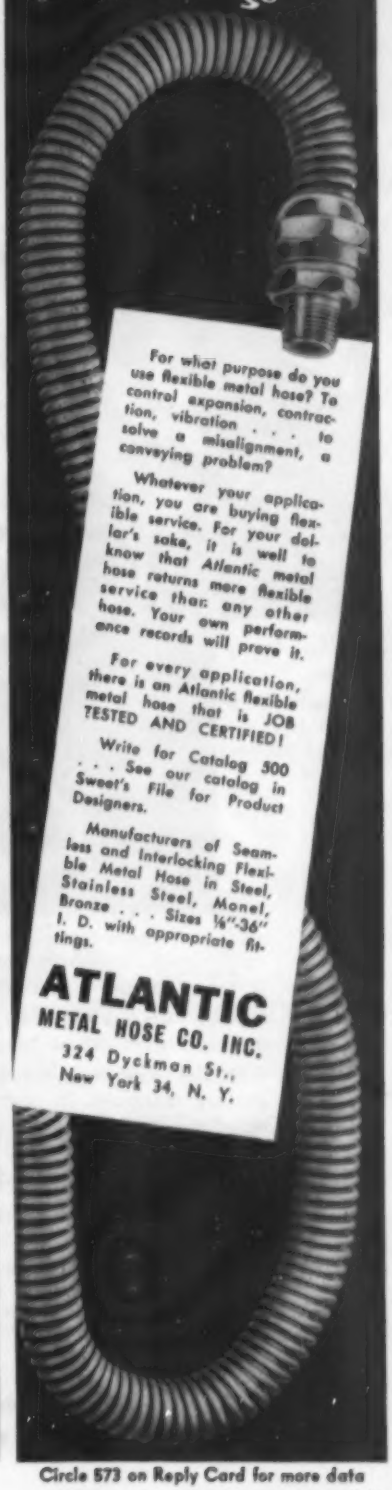

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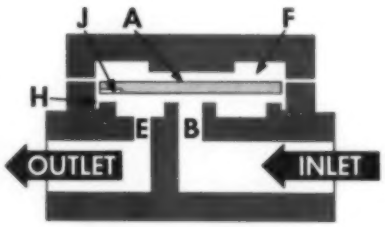

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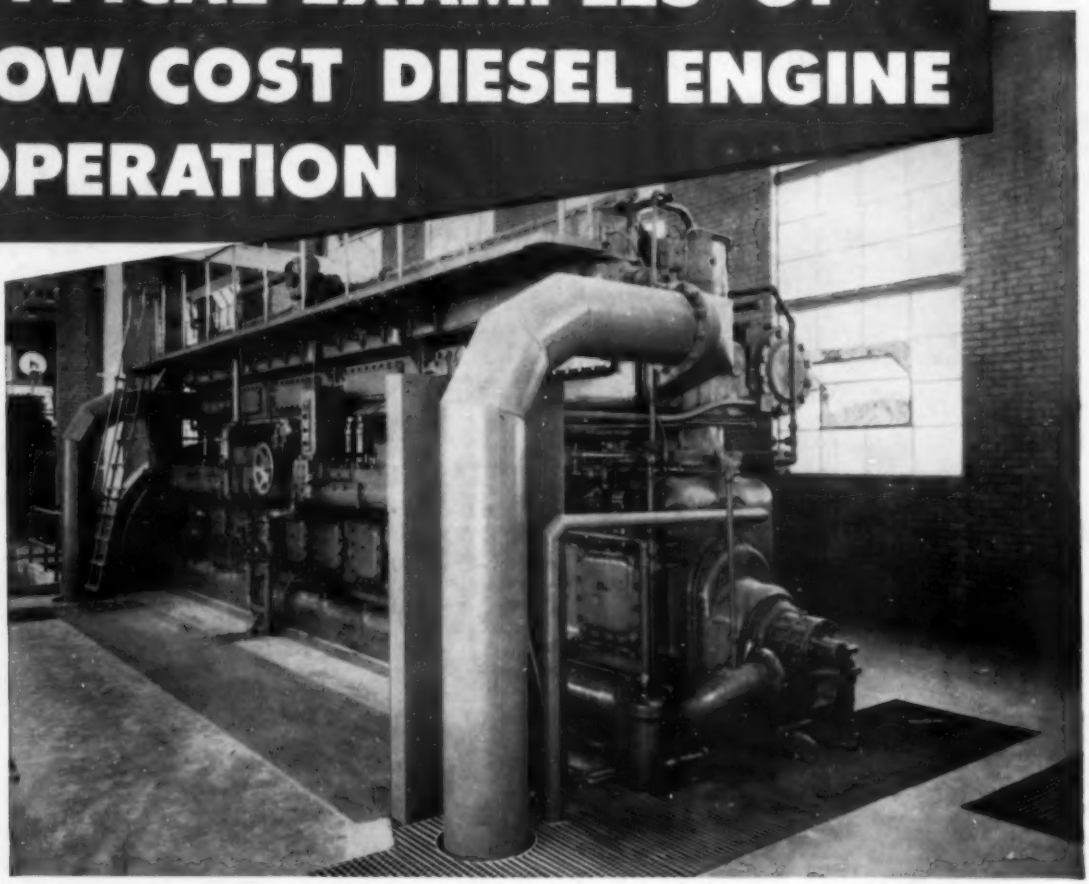

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